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AMERICAN JOURNAL OF ORTHODONTICS

OFFICIAL PUBLICATION OF
THE AMERICAN ASSOCIATION OF ORTHODONTISTS,
ITS COMPONENT SOCIETIES, AND
THE AMERICAN BOARD OF ORTHODONTICS

PUBLISHED BY THE C. V. MOSBY COMPANY, ST. LOUIS 3, U. S. A.

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Vol. 46, No. 10, October, 1960. American Journal of Orthodontics is published monthly by The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo. Subscription rates: United States and its Possessions $10.00 a year; Canada, Latin-America, and Spain $10.50; Other Countries $11.00. Special rate for dental students and dentists on residency programs, one-half of the domestic rate; for students in other countries, one-half of the domestic rate plus full amount of the applicable charge for international postage. Single copies $1.75 postpaid. Second-class postage paid at St. Louis, Mo. Printed in the U. S. A.

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Earl E. Shepard, St. Louis, Missouri, Secretary of the American Association of Orthodontics, 1960-1961.

American Journal
of
ORTHODONTICS

Vol. 46 | Octorer, 1960 | No. 10

Original Articles

THE USE OF CEPHALOMETRICS AS AN AID TO PLANNING AND ASSESSING ORTHODONTIC TREATMENT

Report of a Case

Cecil C. Steiner, D.D.S., Beverly Hills, Calif.

A CASE treated by Dr. Howard Lang demonstrates the use of cephalometric evidence in planning and assessing orthodontic treatment (Figs. 1 and 2).

Characteristics.—The patient, a boy, was 12 years 3 months old at the time treatment was started. His childhood was normal and average. In both his mother's and his father's families, varied types of faces and dentures were encountered. Some of these dentures were normal, and some of them were in malocclusion. In general, the inheritance of physical qualities was probably better than average as regards both physical development and health. The boy's father was an accomplished athlete and a physical education director.

The patient had the usual childhood diseases. We do not know of any of them that would have influenced his orthodontic treatment or his need for such treatment. The teeth were free of cavities, and the supporting tissues may be described as being normal.

The lip and cheek muscles lacked normal tissue tone. The marked protrusion of the teeth undoubtedly contributed to the lack of normal functioning of the lips. It also inhibited normal breathing and chewing.

Etiology.—Because of the extreme nature of the malocclusion, and particularly because of the narrowness of the dental arches, it is a temptation to suggest sleeping and/or leaning habits as contributing factors of this malocclusion. Instead, we must report that we do not know the cause, although we strongly suspect heredity as the dominate one.

In planning the treatment, evidence from all possible sources was gathered and used. Cephalometric headplates played an important part in this planning and also in the assessment of the changes that took place during and after the treatment time.

The following instructions will show how cephalometric evidence is used for treatment planning and for assessing the changes that take place as a result

Presented before the Rocky Mountain Society of Orthodontists in Aspen, Colorado, September, 1959.

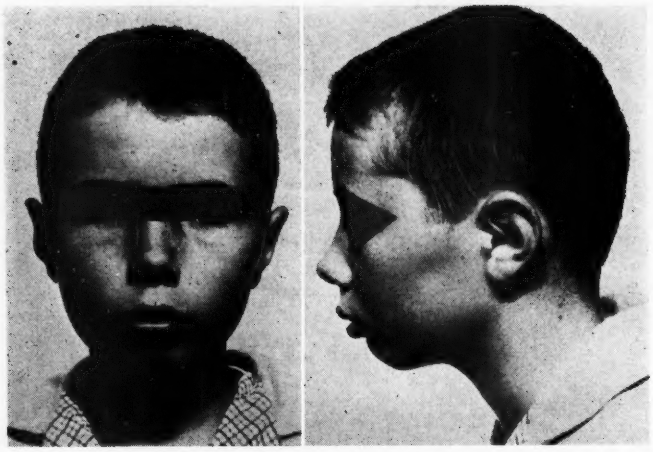


Fig. 1.—Before treatment.

Fig. 2.—Before treatment.

of growth, development, and orthodontic therapy. I will presume that the reader is familiar with my articles entitled "Cephalometrics for You and Me" and "Cephalometrics in Clinical Practice," in which the measurements and methods referred to in the present article are fully described.

VIEWING THE PROBLEM

To view the problem, it is necessary to become familiar with the measurements of our "norm," which we will accept as representing the measurements of a normal average child of average orthodontic age[5] (Fig. 3), and to compare the pertinent measurements of the case at hand with these same measurements of the norm (Fig. 3).

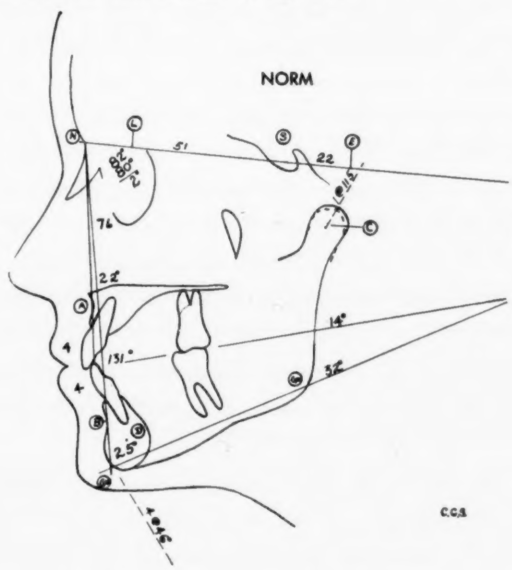


Fig. 3.—Measurements of norm.

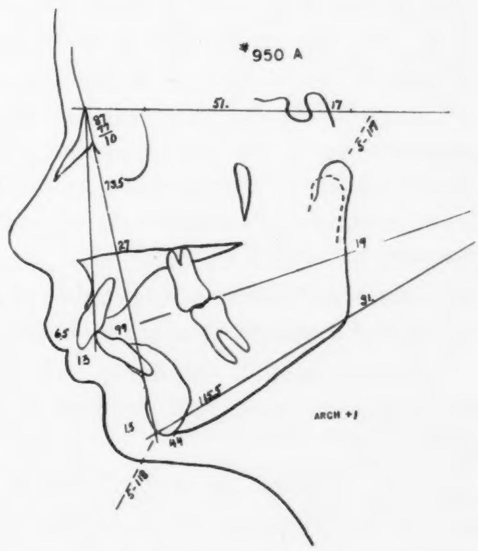


Fig. 4.—Case to be treated.

It will be noted that in the malocclusion shown in Fig. 4 angle ANB is 10 degrees instead of 2 degrees as it is in the norm. The apical base of the mandibular teeth, therefore, is 8 degrees more distally placed in relation to the apical base of the maxillary teeth than is normal.[4] This does not necessarily indicate that the mandibular apical base is distally placed in relation to the head as a whole. It could be that the fault lies with the maxilla. Comparison of angles SNA and SNB with the norm[5] will give some evidence (not conclusive) of which is at fault. Angle SNB is 77 degrees; therefore, it is only 3 degrees short of the norm for it (80 degrees), so the mandible probably is not seriously at fault. Angle SND,[6] which is an assessment of the anteroposterior position of the chin area of the mandible, is 73.5 degrees instead of the norm of 76 degrees. This is corroborative evidence that the chin is short by only about 2.5 degrees. The balance of the error in the apical base relationship is due to a forward positioning of the maxilla. Angle SNA is 87 degrees instead of 82 degrees, which gives further support to this opinion. There is conclusive evidence that there is disharmony in the relationship of the jaws to one another

and that we are dealing with a "distal occlusion," generally referred to as an Angle Class II malocclusion. Examination of the incisors, indicates a Class II, Division 1 malocclusion.

Let us look now at the upper incisor. It measures 6.5 mm. in front of the line NA, instead of 4 mm. as shown on the norm. It is, therefore, 2.5 mm. too far forward. Comparing its angle to that of the norm, we find that it is tipped forward excessively by 5 degrees.

Next let us examine the lower incisor. Here is the key to the severity of this case and to the difficulty of its treatment. The norm for this tooth places it 4 mm. in front of the line NB with its long axis at 25 degrees to this line. This incisor is 13 mm. in front of the line NB and at an angle of 44 degrees. to it. This means that the tooth is 9 mm. too far forward and leaning forward 22 degrees more than is normal for it.

Comparing the measurement Pg-NB (pogonion to the line NB) to the measurement $\overline{\text{I}}$-NB (lower incisor to the line NB), Holdaway[3] believes that ideally these two measurements should be equal. In this case Pg-NB measures 1.5 mm. and $\overline{\text{I}}$-NB measures 13 mm. There is, therefore, a difference of 11.5 mm. between $\overline{\text{I}}$-NB and Pg-NB.

The lower incisor's angulation to the Frankfort plane (Frankfort-mandibular incisor angle of Tweed[7]) is 36 degrees.

By any and all standards, this lower incisor is badly displaced forward of its supporting base, and the case may be said to be one of a severe "double protrusion."

The "mandibular angle" which we read as the angle GoGn-SN (cant of the mandible to the SN plane) is 31 degrees. This is within 1 degree of normal, which indicates good growth in the condylar growth area and a normal ramus height.

Now let us read the measurements SL and SE. Combined, they represent the effective length of the mandible projected onto the line SN. They measure 68 mm., which is only 5 mm. short of the normal average. The measurement SL, at 51 mm., is exactly as it occurs on our normal chart and indicates a relatively normally developed mandible. In this Class II malocclusion case, therefore, the malformation is principally in the maxilla and the maxillary teeth. The lower teeth are placed in a nearly normal mandible, but they are leaning badly forward.

The occlusal plane is canted to the SN line at 19 degrees instead of at 14 degrees. Therefore, it is tipped 5 degrees too much in its relation to this line. This type of error occurs regularly, but in varying degrees, in conjunction with Class II malocclusions. It generally has a relationship to the variations of the mandibular plane (GoGn-SN). Its correction is thought by many orthodontists to be important to the treatment of both Class II and Class III malocclusions. It is of interest that the use of Class II rubber ligatures generally tends to make it worse. Extraoral anchorage, particularly when it is used with the Kloehn type of face-bow, can be made to improve it.

Let us look now at the action of the condyles and of the chin point when the mandible is moved from closed to rest position. Normally, the condyles move for this distance on what is referred to as "the terminal hinge axis." The center of this axis is generally located not in the center of the condyle but in its lower portion, or even in the upper part of the neck of the condyle itself. Normally, point C (center of the condyle) moves downward and forward about 1 mm. at 115 degrees to the line SN. In the malocclusion under consideration here the condyle moves 5 mm. and at 119 degrees to the line SN.

The chin point normally moves from the closed position to the rest position, *downward* and *backward* about 4 mm. and at about 46 degrees to the line SN. In this malocclusion case, the chin moves *downward* and *forward* 5 mm. and at 118 degrees. This has been referred to as the "Sunday bite," but we should bear in mind that cephalometric evidence shows that this abnormal opening is typical of the majority of Class II malocclusions. It changes toward the normal type of opening coincidentally with good treatment of the malocclusion.

As stated before, cephalometric evidence is important, but it must be compared, tempered, and coordinated with evidence found in photographs, models, and particularly in the patient himself. Teeth in the living denture are mounted in the finest articulator ever devised, and there they and the other parts of the denture give diagnostic evidence that cannot be surpassed in importance.

PLANNING TREATMENT

First the information pertinent to the problem is recorded on the diagram marked "problem" on the analysis sheet[6] (Fig. 5). The improvement in angle ANB that will occur during treatment is estimated and the new estimated angle ANB is recorded on the graph at *A* in the portion of the diagram marked "ANB." (See Fig. 6 for location of *A* and record the figure on the analysis sheet shown in Fig. 5 for this and the following measurements.) The positions of the upper and lower central incisors that this new angle ANB dictates are estimated. (To do this, see the "acceptable compromises" in Figs. 5 and 6 and record at *B* and *C*.) Next an estimate is made of what the measurement pogonion to line NB (Pg-NB) will be at the end of treatment.[6] For evidence, one must consider the growth potential, the distance and manner in which the lower incisor is to be moved, the expectancy of the addition of appositional bone, etc. It must be remembered that "them that has, gets" and vice versa. This estimate is recorded at position *D*. The distance of the point Pg from the line NB, having been estimated, now the position of the lower central incisor from the line NB is estimated. Holdaway says[3]: "A I:I ratio between these two measurements is ideal." Therefore, the distances marked at *D* and also at *E* are recorded, so that these two distances will be recorded as being equal. The position of the upper incisor which is marked *F* on the diagram is established as follows (Fig. 7):

$$F = E - (C - B).$$

$C, B,$ and E are known. Solve for F.

$$F = 3 - (5 - 0).$$

$$F = -2.$$

F and *E* now hold the same relative relationship to the lines NA and NB in both the ANB and the Pg diagrams as do *B* and *C*. In this position, *F* is ahead of *E* the same distance that *B* is ahead of *C* in their respective diagrams.

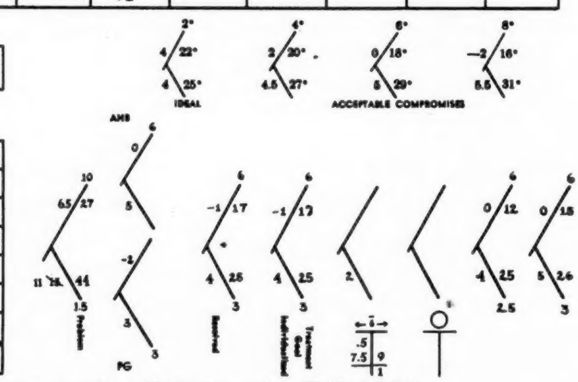
Name: John Doe No: 950 Age: II Sex: Male

CEPHALOMETRIC ANALYSIS
STEINER

		Ref. Norm.						
SNA	(angle)	82°	87	87	83	83		
SNB	(angle)	80°	77	76	77	77		
ANB	(angle)	2°	I0	II	6	6		
SND	(angle)	76° or 77°	73.5	73	74	74		
$\underline{1}$ to NA	(mm)	4	6.5	6	0	0		
$\underline{1}$ to NA	(angle)	22°	27	23	I2	I5		
$\overline{1}$ to NB	(mm)	4	I3	2	4	5		
$\overline{1}$ to NB	(angle)	25°	44	I0	25	26		
Po to NB	(mm)	not established	I.5	2	2.5	3		
Po & $\overline{1}$ to NB	(Difference)		II.5	0	I.5	2		
$\underline{1}$ to $\overline{1}$	(angle)	131°	99	I35	I37	I33		
Occl to SN	(angle)	14°	I9	I8	I9	I9		
GoGn to SN	(angle)	32°	3I	3I	32	34		
SL	(mm)	51	5I	49	52	52		
SE	(mm)	22	I7	I8	I7.5	I7.5		
Arch length discrepancy			+I					

(mm)	+	−
Correcting Arch Form Moves $\overline{1}$		2

LOWER ARCH	+	−
Discrepancy	1	
Expansion		0
Relocation $\overline{1}$		14
Relocation $\overline{6}$	1	
Intermaxillary		4
Extraction	15	5
Total Net		6



* *These estimates are useful as guides but they must be modified for individuals.*

c.c.

Fig. 5.—See Fig. 6 for letters representing the positions on these charts.

We have now established the positions of the upper and lower incisors, as they are dictated by the angle ANB, as being *B* and *C*. We have established the positions of the upper and lower incisors, as they are dictated by the distance Pg to the line NB, as being *F* and *E*. Both are important. Therefore, both of these diagrams should be resolved into one by establishing the average of them. This is recorded on the diagram labeled "resolved." *A* and *D* are carried over intact. The average between *B* and *F* is estimated as follows: $B + F \div 2 = G$. In like manner, *H* is established by the following formula: $C + E \div 2 = H$.

G represents the distance, in millimeters, of the upper incisor ahead of the NA line. To determine what the angle of this incisor to the line NA should be, one may look at the acceptable compromises. The angle should be established from these diagrams and recorded at *I*.

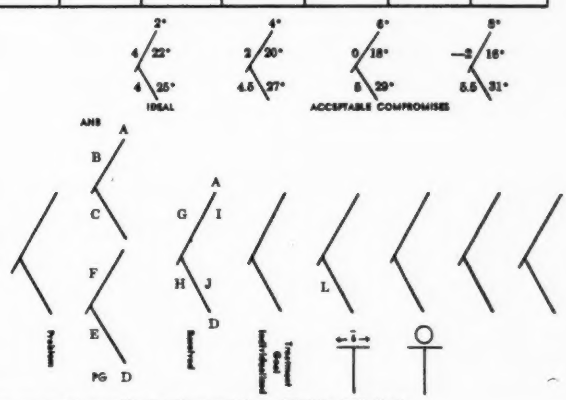
Name: No: Age: Sex:

CEPHALOMETRIC ANALYSIS
STEINER

		Ref. Norm.						
SNA	(angle)	82°						
SNB	(angle)	80°						
ANB	(angle)	2°						
SND	(angle)	76° or 77°						
$\underline{1}$ to NA	(mm)	4						
$\underline{1}$ to NA	(angle)	22°						
$\overline{1}$ to NB	(mm)	4						
$\overline{1}$ to NB	(angle)	25°						
Po to NB	(mm)	not established						
Po & $\overline{1}$ to NB	(Difference)							
$\underline{1}$ to $\overline{1}$	(angle)	131°						
Occl to SN	(angle)	14°						
GoGn to SN	(angle)	32°						
SL	(mm)	51						
SE	(mm)	22						
Arch length discrepancy								

(mm)	+	−
Correcting Arch Form Moves $\overline{1}$		K

LOWER ARCH	+	
Discrepancy		
Expansion		
Relocation $\overline{1}$		
Relocation $\overline{6}$		
Intermaxillary		
Extraction		
Total Net		



* *These estimates are useful as guides but they must be modified for individuals.*

Fig. 6.—Chart showing positions for numbers.

H represents the distance, in millimeters, of the lower incisor ahead of the line NB. Its angle to the line NB may be determined from the diagrams of "acceptable compromises" and recorded at *J*.

These estimates are useful as guides but they must be modified for individuals. Now, the orthodontist must use his training, his experience, and all the intelligence and skill at his command to individualize these figures and mark these modified estimates on the graph marked "treatment goal individualized." Surely, one set of figures is not applicable to all ages, to all races, and to all

types, or even to all temperaments. For the sake of simplicity, I will say that this particular patient conforms in all ways to the standard from which our average normal standards were derived. Let it be made plain, however, that when there are indications for doing so, we do alter for individual patients figures which have been arrived at by these methods.

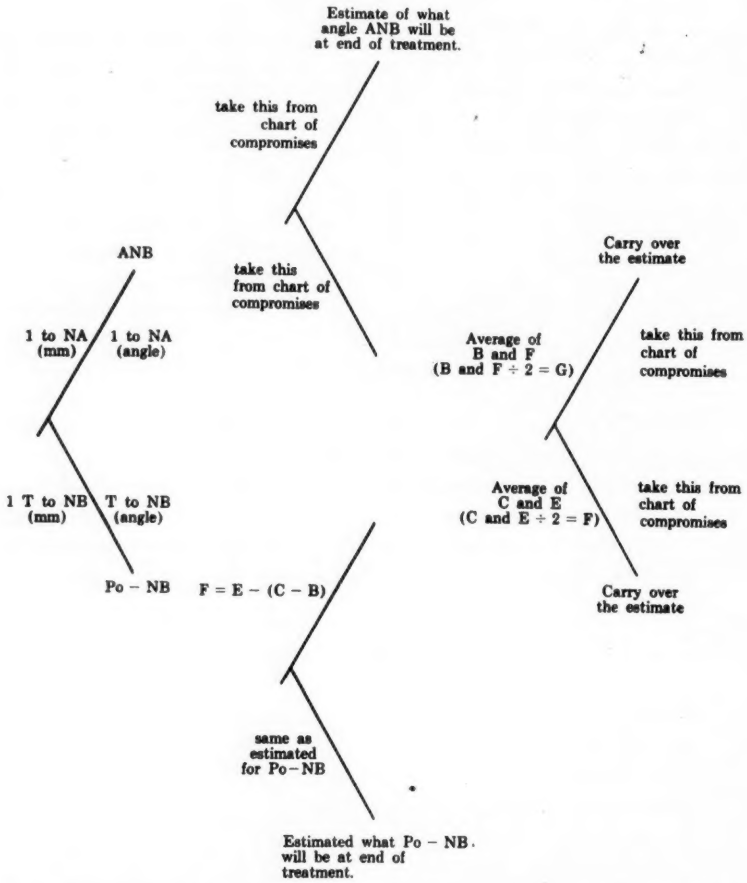


Fig. 7.—See Fig. 6 for letters representing positions on these charts.

HOW TO ACCOMPLISH THE PLANNED TREATMENT

We have made an estimate of what we think should be accomplished. Let us now make some estimates of what the treatment should be.

When the lower central incisor was traced from the headplate, it could or could not have properly represented the true average anteroposterior positions of the other mandibular teeth. It might, for instance, be the only lower tooth that is crowded out of the general arch alignment. In that case, it would be erroneous to say that all the lower teeth are forward of their correct environment to the same degree as this particular tooth. We must first visualize the tooth back in a good alignment with its neighbors before we can use it to judge the positions of the other lower teeth. Therefore, we must make an estimate

of how far forward of the general alignment it is and make a correction in our figures for it. Let us say that we estimate it to be 2 mm. forward of the general alignment. It would then be necessary to imagine it back 2 mm. We would mark 2 on the minus side of the box labeled "correcting arch form moves $\overline{1}$" and, in addition, subtract 2 from the 13 (position of the lower incisor as it was traced), leaving 11. We now cross out the 13 and write 11, this being the position of the incisor when it is visualized in acceptable arch form.

Also, the shape of the arch might not be normal for the case; therefore, the location of the incisor in this abnormal arch form might not truly represent the location of the average positions of the remaining teeth of the arch. In this particular case the arch is narrow and pointed. To visualize the teeth in good arch form, it is necessary to picture mentally the widening of the cuspid areas and the retraction of the central incisors about 2 mm. Therefore, as described in the preceding paragraph and for the same reason, we write 2 in the minus side of the box, cross out the 13, and replace it with 11 (Fig. 5).

Now we look at the box marked "lower arch + and –." The arch length discrepancy of this case is + 1. It should be marked on the plus side, opposite the word "discrepancy." The amount of expansion that can be accomplished and maintained for this particular case is now estimated. We must remember that when the narrow, peaked arch form was changed to a flatter one, the arch was already expanded laterally. I would therefore say that no further expansion can be achieved and would record 0 opposite the word "expansion."

How much will the arch length be decreased by moving the incisors from 11 mm. back to 4 mm.? The answer is 14 mm., for moving the incisors back this 7 mm. shortens the arch length 7 mm. on the left side and also 7 mm. on the right side, for a total of 14 mm. We record this on the minus side opposite "relocation $\overline{1}$."

How much arch length can be gained *and held* by erecting or by bodily moving the lower first molars backward?[2] Let us say that in this case there is no evidence that these teeth have drifted forward of their normal positions. However, the case does present an excessive curve of Spee, and we will estimate that each molar crown will be erected and moved backward 0.5 mm. when the curve of Spee is flattened to what would be considered normal for it. This will gain approximately 0.5 mm. on each side, or 1 mm. for both sides combined. Hence, we mark 1 mm. on the plus side for "relocation $\overline{6}$."

This is a Class II malocclusion. We will arbitrarily estimate that if it is treated in the orthodox manner with intermaxillary rubber bands, and if this is done in a skillful manner, each lower first molar will come forward in the mandible about 2 mm. Considering both sides, this will shorten the arch length 4 mm., so we mark 4 on the minus side opposite "intermaxillary."

Shall we extract? Let us look at the score so far. We have a total of 2 on the plus side and 18 on the minus side. That gives us a net score of minus 16 mm. If we extract, we will create approximately 15 mm. of space in the arch. If we close it by orthodox methods, exclusive of extraoral anchorage we will lose about one-third of this gain by bringing the molars forward.

This means that extracting would give us a net gain of 10 mm. of arch length. Certainly, we need this space, so we will extract. Therefore, we mark 15 on the plus side and 5 on the minus side. (It is possible that we cannot afford the luxury of closing the space in the orthodox manner but must resort to other means to save this expenditure of 5.)

As the matter now stands, even after we have extracted we still have a total net figure of minus 6. That means that, using the orthodox methods of treatment alluded to, we must either be satisfied with finishing the case with the lower incisors 3 mm. too far forward (6 mm. ÷ 2 sides = 3 mm.) or resort to other methods of treating it.

Let us review our figures and see where we might gain or save these 6 mm.

Arch discrepancy: We could strip or cut down the size of the teeth. I would consider that to be out of the question for this case.

Expansion: We could expand the arches. We had decided that this should not be done, however, for the reason that they probably would not stay expanded.

Relocate $\overline{1}$*:* We could, of course, leave the lower incisors 3 mm. forward of the positions planned for them. That would do it, but we want the lower incisor at 4 mm., not 7 mm.

Relocate $\overline{6}$*:* That would be a nice way to do it. It would mean moving each lower molar backward 3 mm., and it undoubtedly could be done. The question is: Does the molar belong behind where we found it and, if not, will it stay behind its rightful place? Until we have more evidence to answer this question, let us look elsewhere for an answer to our problem.

Intermaxillary rubber ligatures: Here is a place where we can save 4 mm.—just do not use intermaxillary ligatures but use extraoral anchorage instead and/or "anchorage preparation," which involves the use of extraoral anchorage and Class III ligatures to store anchorage in the mandible in preparation for using the Class II ligatures.

Extraction: We had planned to close the spaces provided by the extractions in the "orthodox" manner, using intraoral anchorage for the purpose. We cannot afford it. We can use intraoral anchorage to close some of it (until we lose 2 mm. of arch length, which means that each molar drifts forward 1 mm.). After that, the anchorage must be developed outside the mouth and either be used directly for the purpose or stored as "anchorage preparation."

ANCHORAGE PREPARATION

Charles H. Tweed, who deserves credit for popularizing the term "anchorage preparation"[7] and for pointing out its benefits, says, in effect: "Anchorage preparation is the placement of the anchorage teeth into such positions of advantage as will best resist pull upon them." Let me add that anchorage preparation

can also be said to be such placement of the anchorage teeth as will result in their being in the desired places for them after they have been used for anchorage. This generally means carrying the anchor teeth back beyond their desired permanent positions far enough to offset what they will lose when used for anchorage.

Let us now determine where the incisor and the molar should be, *before* they are pulled upon for anchorage, in this particular case. We will consider the lower incisor first. We want it to be finally placed 4 mm. in front of the line NB. If it is to be pulled forward 2 mm. by the Class II intermaxillary ligature (loss of anchorage), then it should be prepared for this loss by placing it 2 mm. back of its final position (4 mm. − 2 mm. = 2 mm.). The position of the lower incisor at the time anchorage preparation is completed is 2 mm. We record this at *L* on the diagram provided for this purpose, which can be identified by the $\overline{6}$ and the two arrows (one pointing forward and one pointing backward). The lines above the $\leftarrow 6 \rightarrow$ are for the incisors, and those below it are for the molars.

Let us consider now the anchorage preparation position of *one* lower first molar. Ignoring all else, how far would each molar have to be moved to correct the crowding or the spacing of the teeth anterior to them? The arch length discrepancy of this case is + 1. Therefore, *each* molar conceivably could come forward 0.5 mm. because of this space. This is recorded under the arrow pointing forward. We have envisioned the teeth in good arch form and in contact; if we were to move the incisor from its adjusted original position of 11 mm. to the estimated position in anchorage preparation of 2 mm., how far would the molar have to be moved to stay out of the way? Subtracting 2 mm. from 11 mm., we find that the molar would have to be moved backward 9 mm. This is recorded under the arrow pointing backward. Obviously, this is impractical; therefore, we extract.

Again considering only a single principle, how much room would the extraction of a premolar provide for the molar to move forward? We estimate the width of the average lower first premolar to be 7.5 mm. The answer, therefore, is 7.5 mm., which is recorded under the arrow pointing forward. The net answer to the two columns is 1 mm. on the distal side. This means that at the time the anchorage preparation is complete, and with the premolar space closed, the molar should be 1 mm. distal to its original position.

Let me restate the problem of the molar in terms that may seem simpler. The space provided by the arch discrepancy (0.5 mm. on a side) plus the space provided by extraction of the premolar (7.5 mm. on a side) is 8 mm. The incisor is to be retracted 9 mm. This means that the combined spaces of 8 mm. will provide 8 mm. of the needed space and the other 1 mm. must be provided by moving the molar back that distance. This is its position at the time anchorage preparation is complete. In other words, in this position the molar is placed far enough back of its permanent position to offset what it will lose in position when it is used for anchorage.

RESULTS ACHIEVED

Our goal for the anchorage preparation for this case is shown in Fig. 5. The tracing in Fig. 8 shows the case with the anchorage prepared and ready for Class II intermaxillary rubber band therapy.

Our goal for the treatment of the case at the end of treatment is also shown in Fig. 5 and is captioned "treatment goal individualized." The tracing in Fig. 9 was made at the time the bands were removed. Notice the incisor and molar lines that record where these teeth were formerly located. These lines are described in my article entitled "Cephalometrics in Clinical Practice."[6]

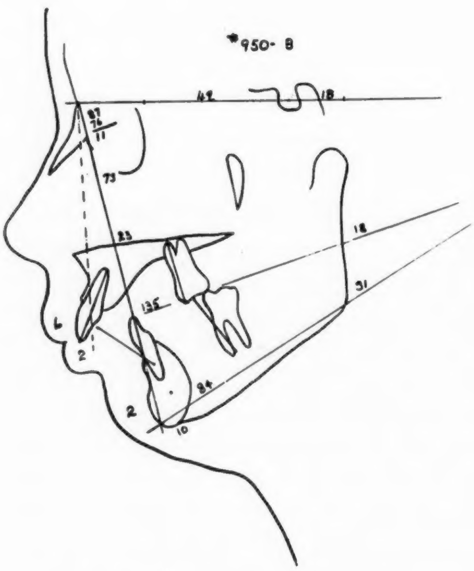


Fig. 8.—The anchorage preparation.

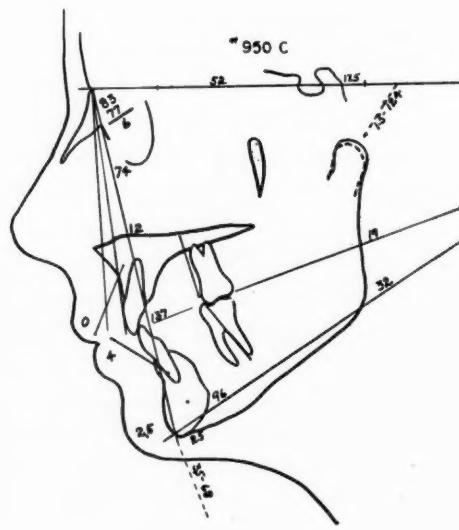


Fig. 9.—At the end of treatment.

The models and the photographs of the case at this time are shown in Figs. 10 and 11. Fig. 12 shows the case one year after treatment and Fig. 13 shows it five years after treatment.

CONCLUSION

The foregoing case was treated some years ago with Angle's edgewise appliance. Full use was made of the principles of anchorage preparation and subsequently of Class II rubber ligature pull.

Treatment consisted of stabilizing the maxillary teeth with the edgewise appliance on the buccal teeth, the use of a palatal plate in an attempt to gain some stability from the palate, and the generous use of a neck strap and a Kloehn type of face-bow with the outer bow aligned high to resist further the displacement of the maxillary teeth.

Against this maxillary anchorage, Class III, rubber ligatures were used to move the mandibular teeth to positions of "anchorage preparation" which, to my mind, means positions of advantage not only to resist rubber pull but

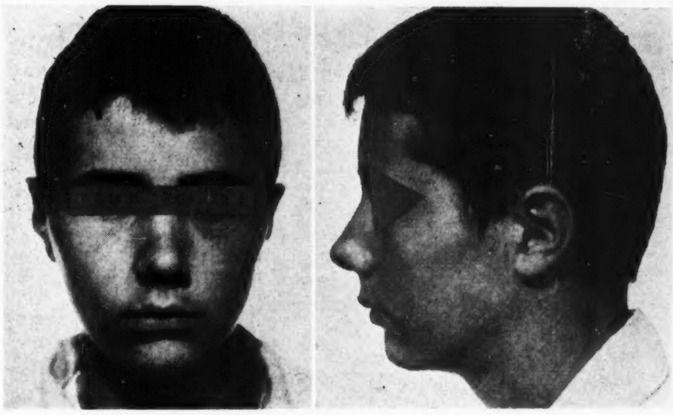


Fig. 10.—After treatment.

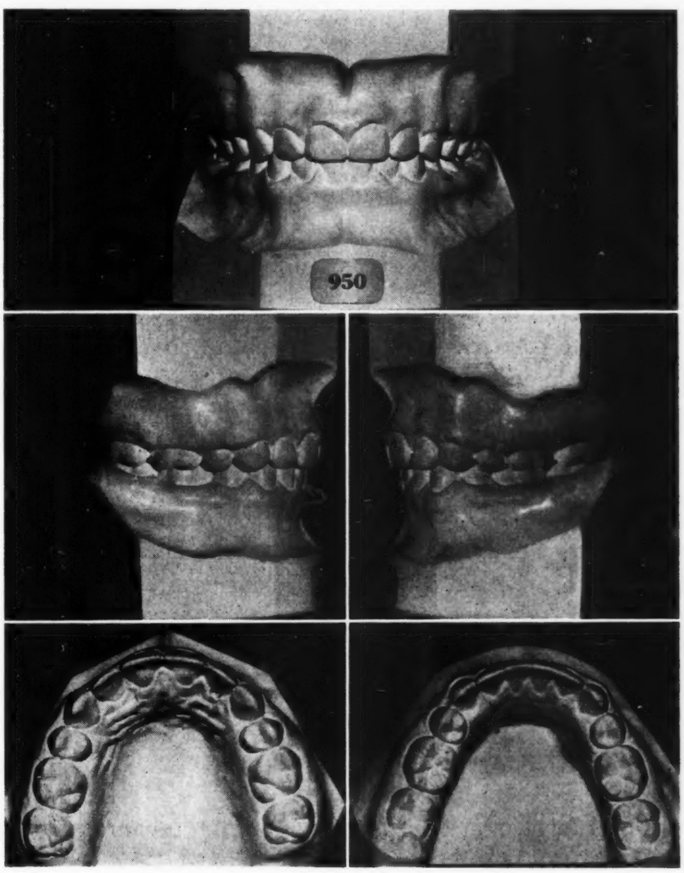


Fig. 11.—After treatment.

also to result in their correct positions after they have been subsequently pulled upon by the Class II rubbers. This means that the mandibular teeth were moved 2 mm. too far distally and then brought forward to their correct positions as a result of wearing the Class II rubber ligatures.

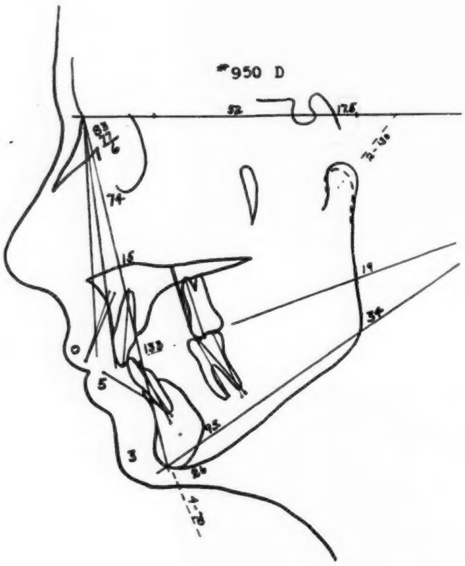


Fig. 12.—One year after treatment.

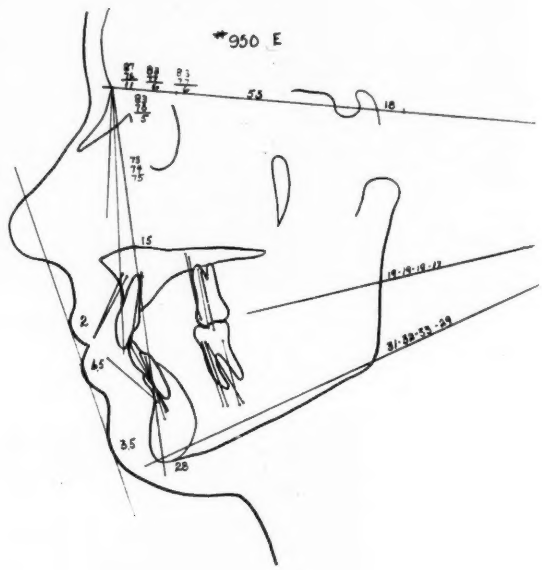


Fig. 13.—Five years after treatment.

In view of evidence seen in cephalometric headplates and from other clinical observations, both Dr. Lang and I believe that it is also possible to treat cases of this type to advantage by positioning the mandibular teeth where they should be by the methods just described and then maintaining them there while the Class II discrepancies are treated by extraoral anchorage. We know of no evidence that mandibles treated in this way show less indication of growth than mandibles that have been subjected to vigorous Class II rubber ligature pull. We definitely do not believe in "jumping the bite." The study of cephalometric headplates is giving proof of the value of some of our orthodontic treatment methods. In some instances it is changing them.

We believe that this method of analysis does assist in treatment planning and in assessing changes that take place naturally and as a result of treatment. For treatment planning, it expresses problems so that they can be easily observed and therefore understood. It helps to make such decisions as when to extract and when not to extract, and it gives an indication of what to extract. It helps to evaluate the results of different types of treatment—for instance, intraoral versus extraoral, stationary versus simple anchorage, and light forces versus heavy ones.

Orthodontics is now going through a period of rapid change. We believe that cephalometrics is an important factor in bringing these changes about, and we hope that this method of using cephalometry is contributing to that end.

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CASE ANALYSIS

Everett Shapiro, B.S., D.M.D.,* Brookline, Mass.

CASE analysis is the systematic study of a disease through an evaluation and correlation of all the constituent signs and symptoms related to the abnormality. In orthodontics, information for case analysis may be divided into distinct categories (after Margolis):

I. General assessment of the child on the basis of information obtained from the parent, physician, or dentist, and the child. This information shall include any abnormal medical or dental history, as well as an evaluation of the nature and temperament of the patient.

All the above information is correlated in an attempt to determine the etiological or predisposing factors influencing the development of the malocclusion or its correction.

II. Assessment of the Orthodontic Records of the Patient.

A. Oriented photographs or visual examination. Balance and harmony of facial lines are evaluated. Attention is focused upon the relationship and fullness of the lips, the prominence or retrusion of the chin, and any strain or tension of the oral musculature.

The orthodontist appraises which features and contours are in imbalance and which can be improved by orthodontic treatment.

B. Cephalometric records—lateral cephalic roentgenogram.

1. Cranioskeletal analysis (CSA). The skeleton of the denture (the maxilla and the mandible) is oriented to the cranium.
2. Dento-cranio-facial orientation (DCO). The denture is oriented to the face and to the skeletal framework. (Cephalometric analysis will be discussed in detail below.)

C. Plaster casts. The malocclusion is classified according to Angle. All local dental irregularities are delineated. These include overbite, overjet, crowding or spacing, rotations, inclinations, cross-bite, tooth discrepancies, and anomalies.

Presented before the Middle Atlantic Society of Orthodontists, Washington, D. C., October, 1959.

*Assistant Professor of Orthodontics, Tufts University School of Dental Medicine.

D. Intraoral and lateral jaw roentgenograms. Roentgenograms are examined for level of root formation and unerupted, impacted, and supernumerary teeth. Any bone pathology is noted, and caries are charted.

III. Integration of Data From I and II Above—Differential Diagnosis. A comprehensive analysis of the malocclusion is made. The deformity is defined in its broad sense. It is differentiated from similar orthodontic discrepancies, and this differentiation suggests the basis for (1) the objectives of treatment, (2) mechanotherapy, and (3) prognosis.

IV. Objectives of Treatment. Here the following questions are answered: (1) Are any facial changes desirable? (2) Are changes in arch relationship indicated? (3) What specific details in the malocclusion need correction?

V. Treatment Plan and Mechanotherapy. What shall be the sequence of the correction? And how shall we get there? Since growth and tissue response is rarely predictable, the orthodontist may modify his original plan of treatment as well as the mechanotherapy during the course of treatment.

VI. Prognosis. The prognosis is an evaluation of two predications: (1) What will happen if the dentition is untreated? (2) How much improvement may be achieved by orthodontic treatment? Will this improvement warrant the time and expense involved?

VII. Retention. (1) What type of retention shall be necessary? (2) If adequate improvement cannot be maintained, treatment is not indicated.

I shall confine my discussion mainly to an assessment of the orthodontic records of the patient, the differential diagnosis, and the objectives of treatment. While there are three major classifications of malocclusion (Angle), there are many more types of discrepancy that are differentiated through assessment of cephalometric records, photographs, and models. In orthodontics there is no one system of analysis that can delineate all the details in the many types of malocclusion, and there is no one system of therapy that prescribes a uniformly acceptable technique of treatment. Yet a careful analysis of the patient's records indicates where the deformity exists or where there is a disproportion in size or relationship of parts.

There are many systems of cephalometric appraisal. The two that I use ordinarily are the Margolis[1] and the Tweed[2] analyses. The salient features of the Margolis analysis are an evaluation of the relationship of the skeletal framework to the cranial base, the relationship of the dentition to the face and to the mandibular plane, and, finally, the relationship of the teeth to each other. The Tweed analysis evaluates disproportions of the mandible to the Frankfort horizontal by means of the Frankfort-mandibular plane angle and relates the inclination of the mandibular incisors to the Frankfort horizontal.

Both analyses lay heavy stress upon the proportions and relationship of the mandible to the skull. Margolis states that if there is good development

of ramus height, the mandibular line extended posteriorly will fall below the base of the occiput or intercept it slightly. In addition, if the body of the mandible is of good size and well positioned, the angle at nasion (N) is 72.6 ± 3 degrees. Tweed's evaluation of mandibular growth rests in the Frankfort-mandibular plane angle. The normal range of the angle is from 16 to 28 degrees. The larger the angle, the more severe is the discrepancy.

The position and inclination of the mandibular incisors are of extreme importance in each analysis. Margolis states that in a well-developed skull the long axis of the mandibular incisors normally is at right angles to the mandibular plane—90 degrees ± 5 degrees. In addition, the facial line normally intercepts the lingual surface of the crown of the mandibular incisor or falls anterior to it. Thus, inclination and position of the incisor are evaluated. The mandibular incisor, however, is not the sole criterion for analysis or extraction.

Tweed relates the inclination of the mandibular incisor to the Frankfort horizontal. Normally, according to Tweed, the long axis of the mandibular incisor extented superiorly forms an angle of 69 ± 5 degrees with the Frankfort horizontal. Thus, in treatment, the Tweed triangle correlates the angulation of the mandibular incisor to the Frankfort-mandibular plane angle. The larger the Frankfort-mandibular plane angle, the smaller is the mandibular incisor plane angle. The criterion for extraction here is quite simple. If an FMIA of at least 65 degrees is not attainable, removal of dental units is recommended.

As an additional criterion, Tweed refers to the ANB difference to determine the severity of the malocclusion. The larger the angle ANB, the more disproportionate are the maxillary and mandibular apical bases. An ANB angle that is larger than 7 degrees indicates a severe discrepancy in which the prognosis is questionable.

Unfortunately, there are no criteria for extraction with which all orthodontists can agree. There are, however, some observations that may be applicable to the choice of extraction in orthodontic treatment. When the maximum additional space is required, the first premolars are extracted. If only a small amount of space is needed, the second premolars are extracted. When a malocclusion is appraised with severe decay or decalcification of the first molars, the extraction of these teeth may be recommended if (1) third-molar buds are evident in x-ray analysis and (2) only a fraction of the extraction space is needed during the course of treatment.

Extraction of the maxillary second molars alone is indicated when (1) the molar relationship is end-on, (2) the overbite is not deep, and (3) no correction is indicated in the mandibular arch.

Although I extracted mandibular second molars in the past, I do not recommend the procedure for the reasons that (1) the third molar cannot be relied upon to erupt in ideal or functional occlusion and (2) correction of deep overbite is hindered by the loss of the second molar.

In the differential diagnosis, photographs, cephalometric records, models, and roentgenograms are assessed as part of the total picture. The malocclusion

may then be classified and differentiated from similar malocclusions as regards both the nature of the deformity and the area where correction is indicated. Thus, the analysis not only classifies and describes the malocclusion but also the groundwork for future corrective procedures.

The following cases illustrate some of the essential features of case analysis.

CASE 1.—The patient, Jeff C., is a 12-year-old white boy (Fig. 1). The medical and dental history is noncontributory with respect to etiological factors in the malocclusion.

Assessment of Orthodontic Records.—

Oriented photographs: There is a fullness of the lips, and the lower lip rolls out against the incisal edges of the maxillary incisors. The upper lip is short.

Cephalometric analysis: The mandible is well developed in ramus height and body length, since the mandibular line falls tangent to the base of the occiput, and the angle at N is 69 degrees (according to Margolis).

The crown of the mandibular incisor is labial to the facial line, and the long axis of the mandibular incisor forms an angle of 99 degrees with the lower border of the mandible. The Frankfort-mandibular incisor angle is 51 degrees, and uprighting and retraction are indicated.

Analysis of plaster casts: The plaster casts indicate a Class I relationship of the arches and slight crowding of the mandibular incisors. The overbite is moderate, and there is a slight overjet of the maxillary incisors.

Roentgenograms: Intraoral and lateral-jaw films reveal normal dental development. Third-molar buds are evident in both the maxilla and the mandible.

Comprehensive Analysis.—The dental arches are well developed and the superimposed dentition, although not crowded, is procumbent and protrusive. There is no interdental spacing. Stated simply, the malocclusion is a Class I bimaxillary dentoalveolar protrusion.

The objectives of treatment are (1) improvement in the facial profile by reduction of lip fullness (I feel that orthodontic therapy can do nothing to elongate the short upper lip), (2) reduction of incisor protrusion and procumbency, and (3) diminution of overbite and elimination of overjet. To achieve these objectives, extraction of four first premolars is recommended.

Prognosis.—If this malocclusion is left untreated, the child will have a protrusive dentition and procumbent incisors. The slight crowding and inclination of the incisors are a potential source of future periodontal difficulty. In my opinion, the fullness of the lips and oral musculature is objectionable. The improvement to be gained through orthodontic therapy should warrant the time and expense involved.

CASE 2.—The patient was Barry S., a white boy, 11 years of age (Fig. 2). The medical and dental history was noncontributory so far as etiological factors in the malocclusion were concerned.

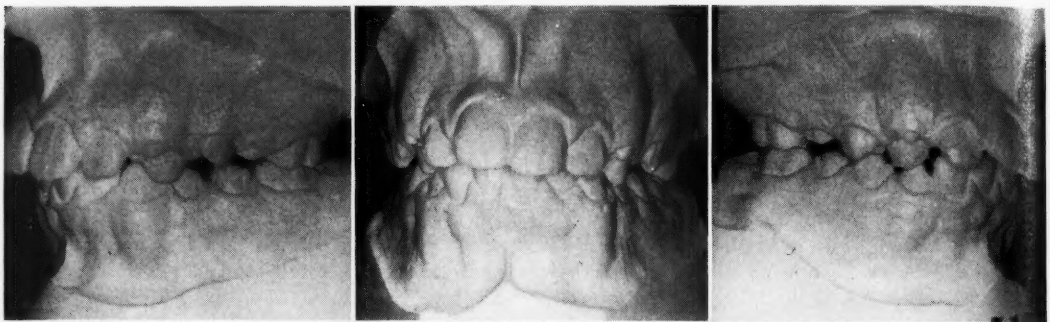
Assessment of Orthodontic Records.—

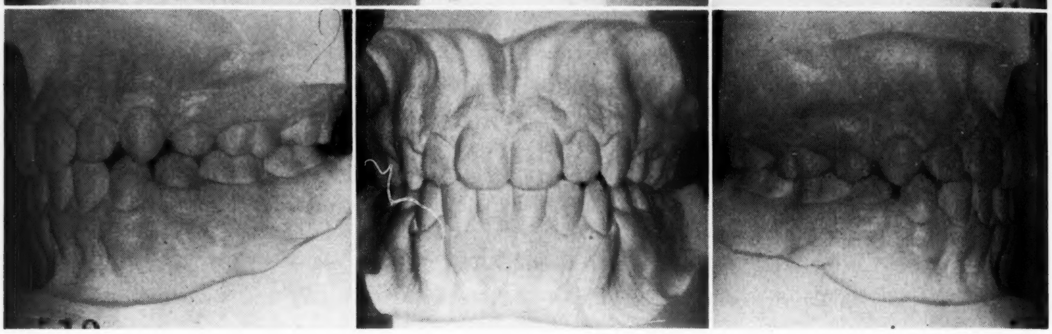
Oriented photographs: There was a fullness of the lips, and the chin lacked prominence.

Cephalometric analysis: The mandibular line (the tangent to the lower border of the mandible) entered the base of the occiput, indicating a short ramus. In such instances, there is the potential danger of open-bite. Chin point was in good anteroposterior relationship to the cranial base, since the angle at N was 69 degrees. The mandibular incisors were procumbent, as evidenced by a mandibular incisor angle of 100.5 degrees (Margolis) and a Frankfort-mandibular incisor angle of 42.5 degrees (Tweed). The mandibular incisors were positioned anteriorly, since the facial line intercepted the lingual surface of the root of the incisors. Both retraction and uprighting of incisors were indicated.

Analysis of plaster casts: The posterior segments were in end-on relationship. There was very little overbite, and overjet was moderate. There was some spacing in the mandibular incisor area but no crowding of posterior teeth.

A.





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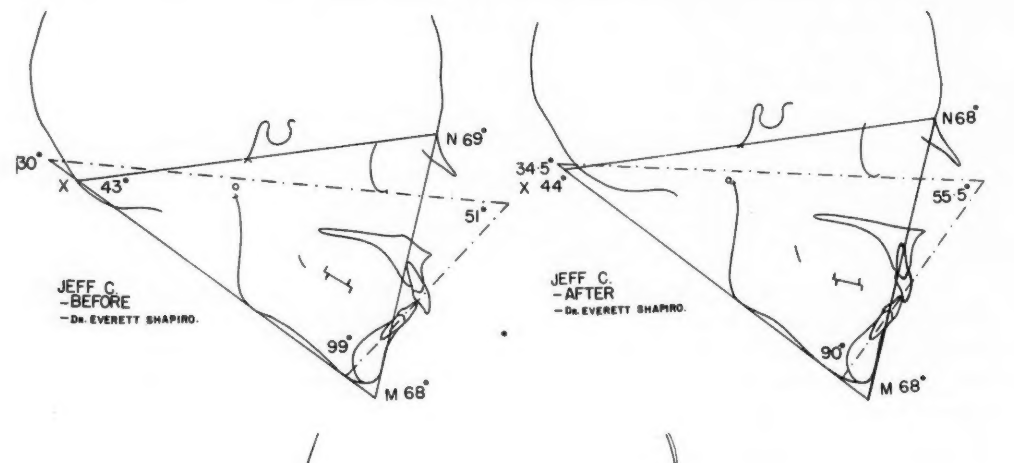
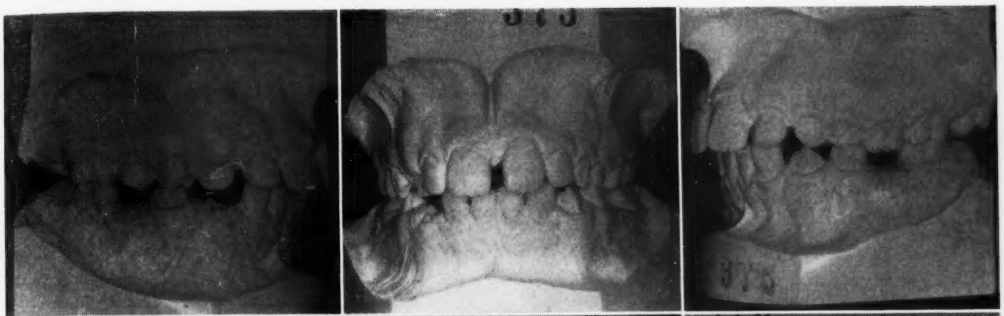


C.

Fig. 1.—Jeff C., Class I (Angle) bimaxillary dentoalveolar prognathism. Four first premolars were extracted. *A,* Before treatment; *B,* after treatment; *C,* tracings of lateral cephalic roentgenograms.

A.



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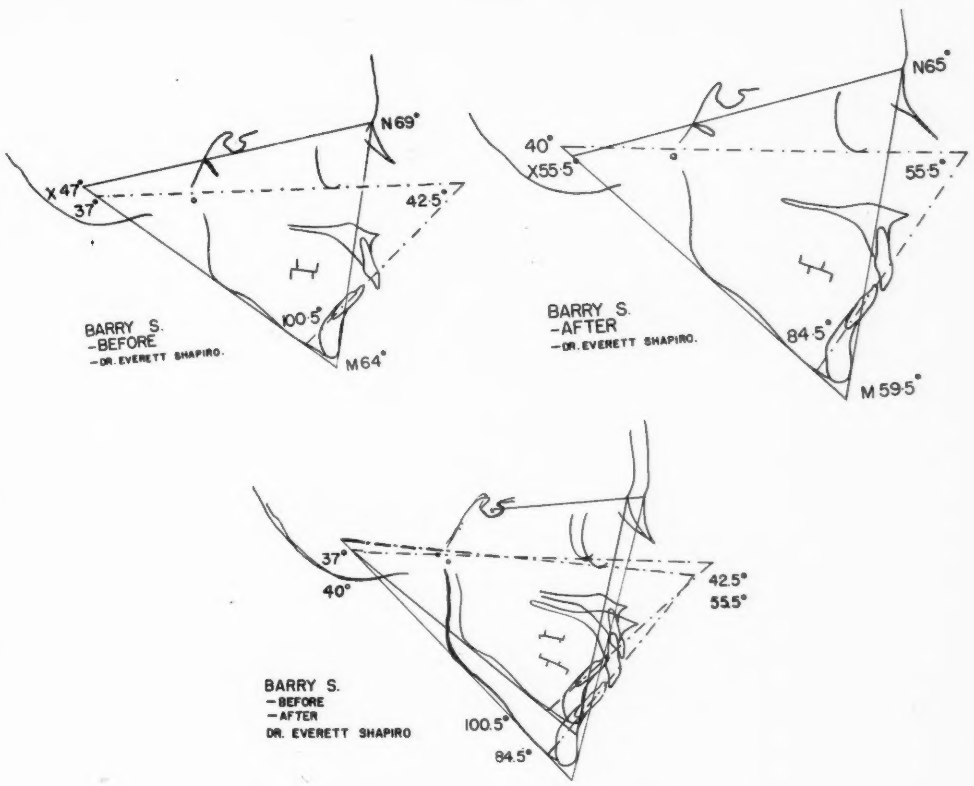


C.

Fig. 2.—Barry S., "end-on" bimaxillary dentoalveolar protrusion with spacing. Treatment proceeded successfully without extraction. *A,* Before treatment; *B,* after treatment; *C,* tracings of lateral cephalic roentgenograms.

Intraoral and lateral-jaw films: Dental development appeared normal, and the unerupted premolars and canines were of normal size. Third-molar buds were evident.

Integration of Preceding Data.—The patient had an "end-on" bimaxillary dentoalveolar protrusion with spacing of the maxillary and mandibular incisors. Mandibular body length was well developed, but there was a short ramus.

The objectives of treatment were (1) reduction of labial fullness and, (2) establishment of a Class I molar and canine relationship.

If the objectives of treatment could not be achieved through space closure and realignment of dental units, tooth extraction might be necessary. Extractions were to be avoided if possible, however, since any extensive posterior movement or elongation might cause an anterior open-bite.

At the conclusion of therapy without extraction, the mandibular incisors were uprighted from 100.5 to 84.5 degrees, and the facial line intercepted the lingual surface of the crown of the mandibular incisors. Although the Frankfort-mandibular incisor angle was increased from 42.5 degrees to only 55.5 degrees, treatment was stopped there.

CASE 3.—The patient was Martha S., an 11-year-old white girl (Fig. 3). The medical and dental history was noncontributory with respect to etiological factors in the malocclusion.

Assessment of Orthodontic Records.—

Oriented photographs: There was fullness of the lips, and the chin was retruded. The lower lip rolled outward in contacting the maxillary incisors, but there was no strain about the oral musculature.

Cephalometric analysis: According to the Margolis analysis, the child had a well-developed mandible but it might be posteriorly positioned in relation to the cranial base (angle N was 66 degrees versus a normal angle of 72.6 degrees).

The dentition was protrusive in relation to the face (mandibular incisors to facial line), and the mandibular incisors were procumbent (the mandibular incisor angle was 104.5 degrees, and the Frankfort-mandibular incisor angle was 50.5 degrees).

Plaster casts: The molar relationship was Class II (Angle), and the maxillary incisors protruded (Division 1). The overbite was deep, and the overjet was marked. There was crowding of both maxillary and mandibular incisors.

Intraoral and lateral-jaw films: There was normal development of all dental units.

Differential Diagnosis.—The basal arches were in good relationship to cranial anatomy, but the superimposed dentitions were protrusive and crowded. The malocclusion was classified as a Class II, Division 1 (Angle) bimaxillary dentoalveolar protrusion with crowding.

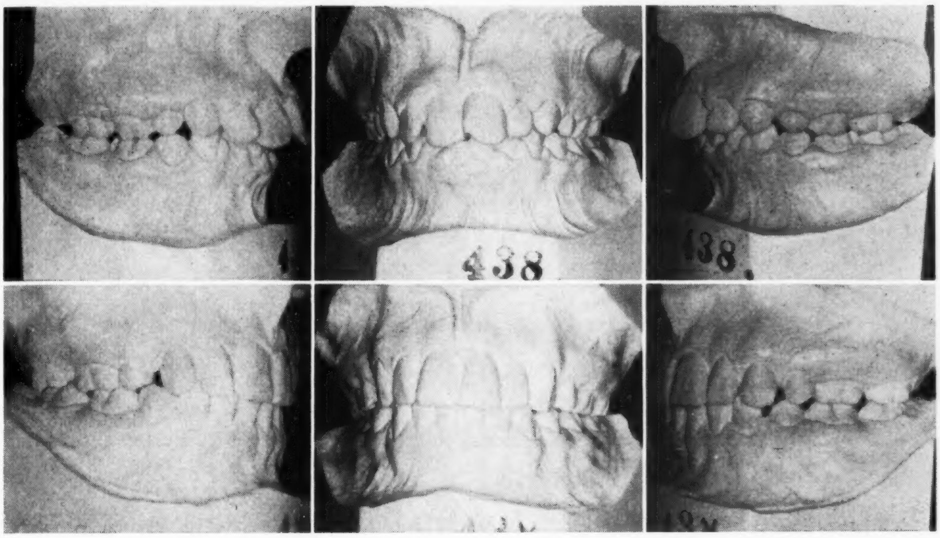
The objectives of treatment were (1) reduction of fullness of the lips, (2) correction of arch relationship and tooth alignment, and (3) decrease in overbite and overjet. To obtain these objectives, four first premolars were extracted.

TREATMENT TIMING

I choose to begin orthodontic treatment when the first premolars are erupting into the oral cavity. My reasons are as follows:

1. In extraction cases the first premolars are usually the teeth to be extracted, and treatment procedures need not be delayed.
2. In Class II malocclusions it is easier to move the maxillary first molars distally before eruption of the second molars.
3. When therapy is near completion, all of the permanent teeth anterior to the second molars will have erupted.
4. In most situations, treatment will be terminated before the patient enters the difficult teenage period.

A.



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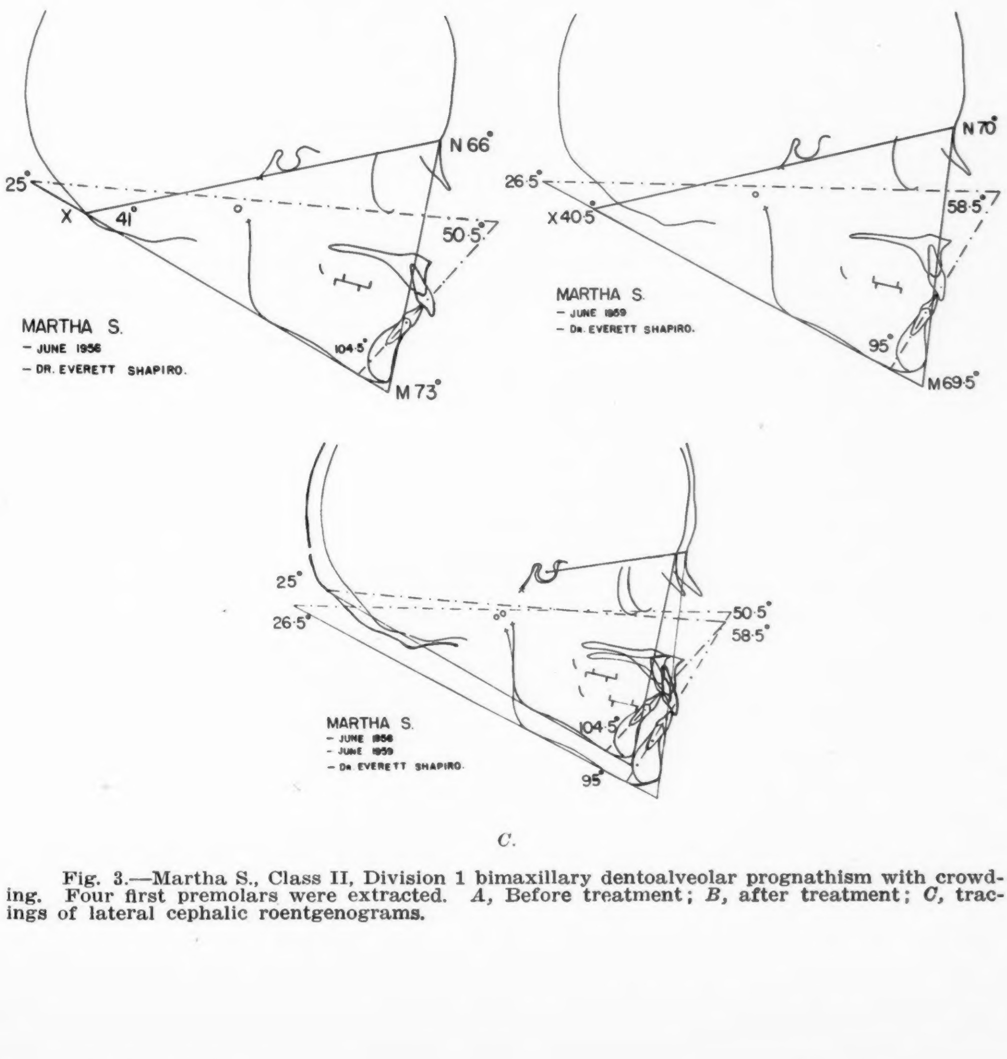


C.

Fig. 3.—Martha S., Class II, Division 1 bimaxillary dentoalveolar prognathism with crowding. Four first premolars were extracted. *A*, Before treatment; *B*, after treatment; *C*, tracings of lateral cephalic roentgenograms.

5. Exceptions to the above are special cases, such as those involving severe protrusions and Class III malocclusions.

Case 4.—Melvin G. was a 10-year-old white boy (Fig. 4). The medical and dental history was noncontributory with respect to etiological factors in the malocclusion.

Assessment of Orthodontic Records.—

Oriented photographs: Photographic examination revealed that the chin was prominent, but not to an extreme degree.

Cephalometric analysis: The cephalic roentgenogram indicated a poorly proportioned mandible. The anteroposterior body length was adequate, but ramus height was deficient. The Frankfort-mandibular angle was 37 degrees, and the mandibular line extended posteriorly entered the base of the occiput. The roots of the lower molars were close to the lower border of the mandible. The mandibular incisor crowns were positioned labial to the facial line.

Plaster casts: There was crowding of the posterior teeth, as well as an incisor cross-bite. There was very little overbite. The molars were in Class I relationship. The maxillary second premolars were unerupted; there was inadequate space for them in the arch.

Intraoral and lateral-jaw films: There was normal dental development of all units, including the third molars.

Integration of Preceding Data.—The patient had a Class I (Angle) bimaxillary crowding with a superimposed anterior cross-bite. There was a possibility of an open-bite due to the short ramus. The mandibular incisors were positioned anteriorly, since the facial line was lingual to the incisor crowns. However, the mandibular incisors were not procumbent, according to Margolis, since the mandibular incisor angle was 88 degrees. The objectives of treatment were (1) correction of the anterior cross-bite, (2) relieved crowding of the posterior teeth, and (3) prevention of any bite opening during therapy. To gain the correction of the anterior cross-bite, lingual movement of the mandibular incisors and slight forward movement of the maxillary incisors were indicated. To facilitate the mechanotherapy, the maxillary second premolars and the mandibular first premolars were extracted.

Case 5.—The patient was Carol B., an 11-year-old white girl (Fig. 5). The medical and dental history was noncontributory so far as etiological factors in the malocclusion were concerned.

Assessment of Orthodontic Records.—

Oriented photographs or visual appraisal: There was a fullness to the upper lip, together with a rolling-out of the lower lip.

Cephalometric analysis:

Cranioskeletal analysis (CSA). The mandible was well developed in ramus height, and there was a prominent chin. The angle at N was 68 degrees indicating a mandible that might be positioned posteriorly, especially since chin point was so prominent.

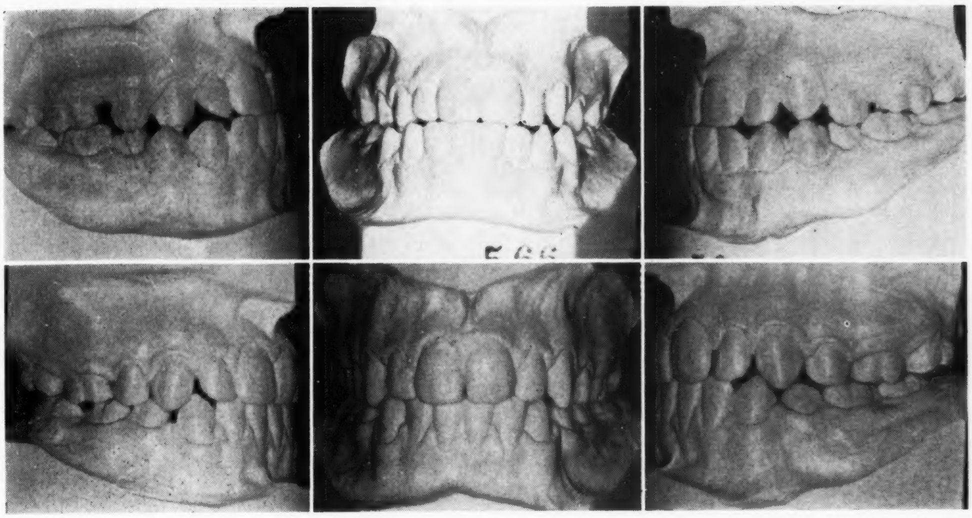
Dento-cranio-facial orientation. The mandibular incisors were in good relationship to the facial line, since the facial line intercepted the lingual surface of the crown of the mandibular incisors. However, the incisors were procumbent, the mandibular incisor angle was 99 degrees and the Frankfort-mandibular incisor angle was 55 degrees.

Orthodontic models: The molar relationship was Class II (Angle) on the left and end-on on the right. The overbite and overjet were excessive. The mandibular denture was well aligned, with no crowding or spacing. There was a slight crowding and protrusion of the maxillary incisors.

Intraoral and lateral-jaw roentgenograms: The bone and root structure appeared normal, and third-molar buds were apparent in both arches.

Integration of Preceding Data.—This was a Class II (Angle) malocclusion with a moderate overbite and a moderate overjet. Since the right side was end-on and the maxillary

A.



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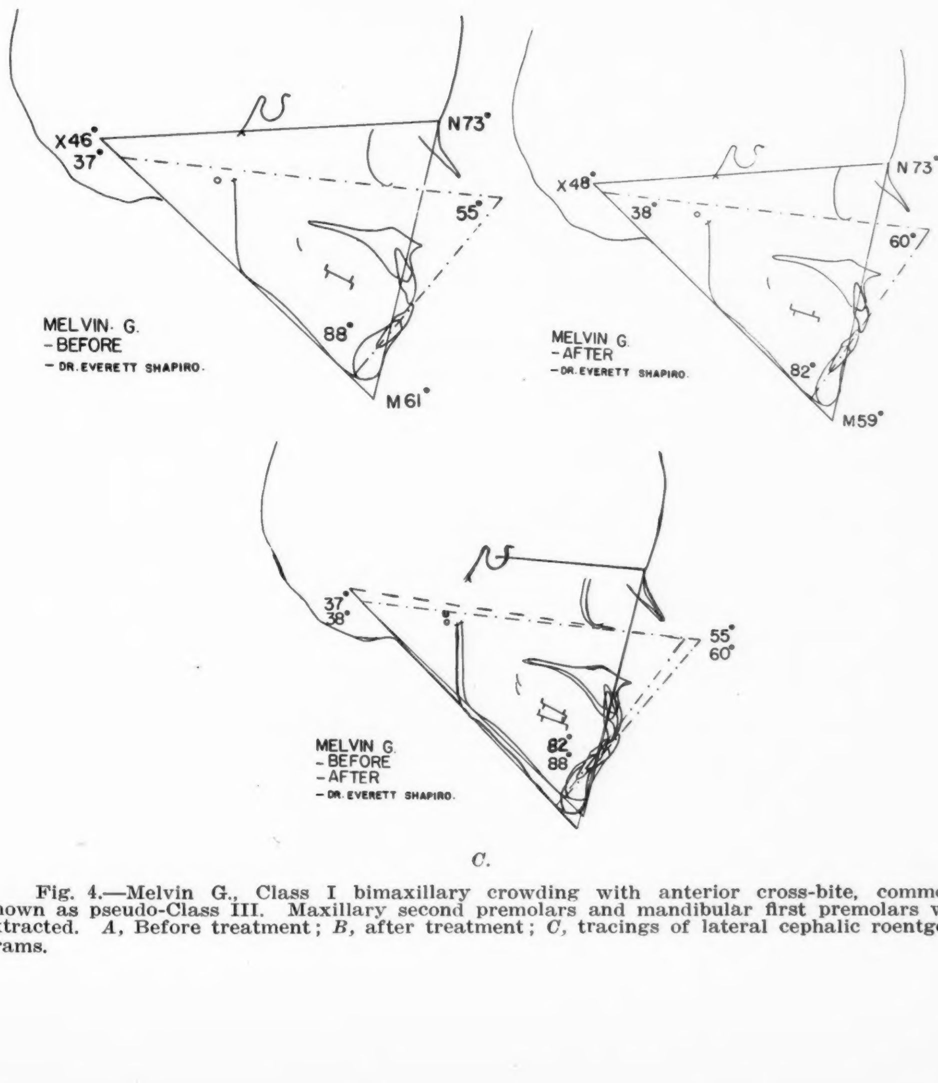
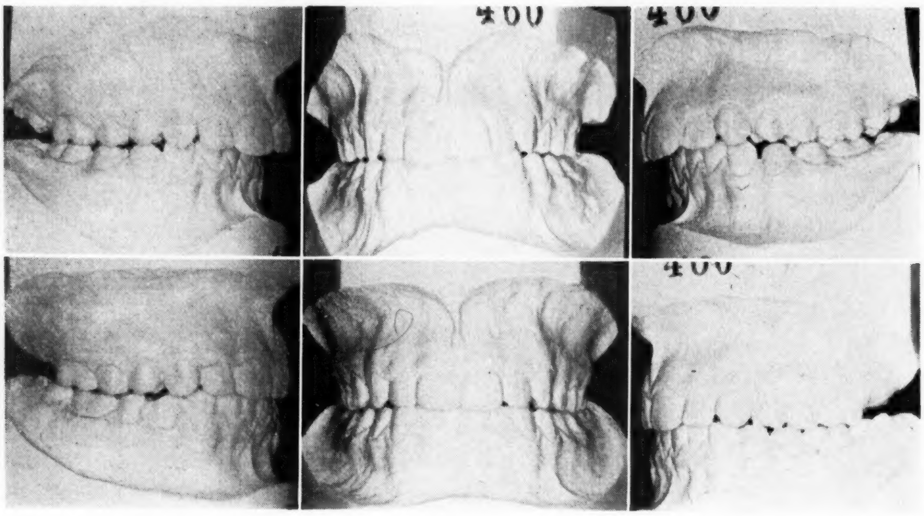


C.

Fig. 4.—Melvin G., Class I bimaxillary crowding with anterior cross-bite, commonly known as pseudo-Class III. Maxillary second premolars and mandibular first premolars were extracted. *A*, Before treatment; *B*, after treatment; *C*, tracings of lateral cephalic roentgenograms.

A.



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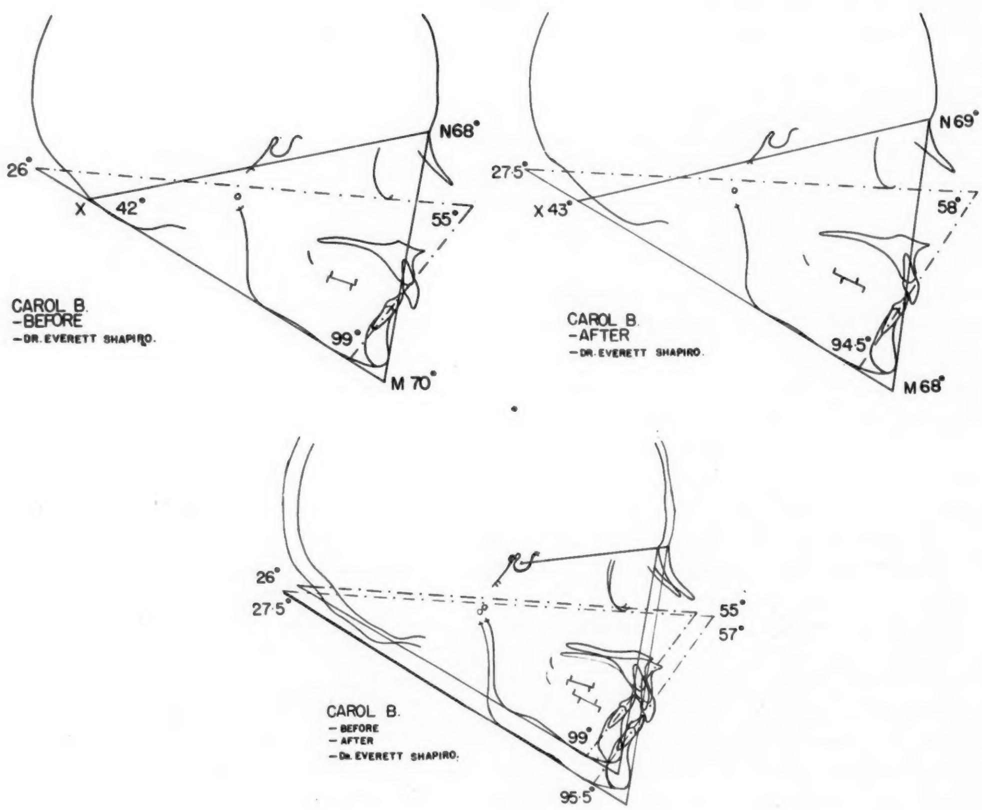


C.

Fig. 5.—Carol B., Class II malocclusion with a well-aligned and well-oriented mandibular dentition. The maxillary second molars were extracted. *A*, Before treatment; *B*, after treatment; *C*, tracings of lateral cephalic roentgenograms.

incisors were not protrusive, the malocclusion may be placed somewhere between Division 1 and Division 2. Although the mandibular incisors were protrusive, they were in good relationship to the facial line. Any excessive uprighting of the incisors would increase the prominence of chin point and detract from facial esthetics.

The objectives of treatment were (1) reduction of fullness of maxillary arch and correction of the Class II molar relationship, (2) maintenance of the stability of the mandibular arch (changes in incisor position and inclinations were not indicated), and, (3) decrease in the overbite and overjet.

The extraction of maxillary second molars was recommended. The well-developed maxillary third-molar buds usually align themselves in good position, posterior to the first molars.

At times it is necessary to work within the framework of a mutilated dentition. Teeth may be carious beyond repair, infected, or missing before orthodontic treatment is started. The orthodontist has to substitute one deformity for another to gain a stable and esthetic denture.

CASE 6.—The patient was Jerry M., a 13-year-old white boy (Fig. 6). The medical and dental history was noncontributory with respect to etiological factors in the malocclusion.

Assessment of Orthodontic Records.—

Oriented photographs or visual appraisal: The lower lip was full and rolled outward to make contact with the incisal edge of the maxillary incisors. The chin was well formed, but supramentale was accentuated.

Cephalometric analysis:

Cranioskeletal analysis (CSA). The mandible was well oriented anteroposteriorly to the cranial base (the angle at N was 70 degrees). The ramus was short, since the mandibular line intercepted the base of the occiput.

Dento-cranio-facial orientation (DCO). The mandibular incisors were protrusive (the facial line intercepted the lingual cingulum), and they were procumbent (the mandibular incisor angle was 103.5 degrees, and the Frankfort-mandibular incisor angle was 41.5 degrees).

Orthodontic models: The molar relationship was Class I (Angle) on the right. On the left a mandibular first molar had been lost, and the teeth had drifted into a Class II relationship. There was a deep overbite and a moderate overjet. There was no midline discrepancy. The mandibular left first and second premolars had drifted distally, while the second molar had drifted mesially. There was slight crowding of the maxillary and mandibular incisors.

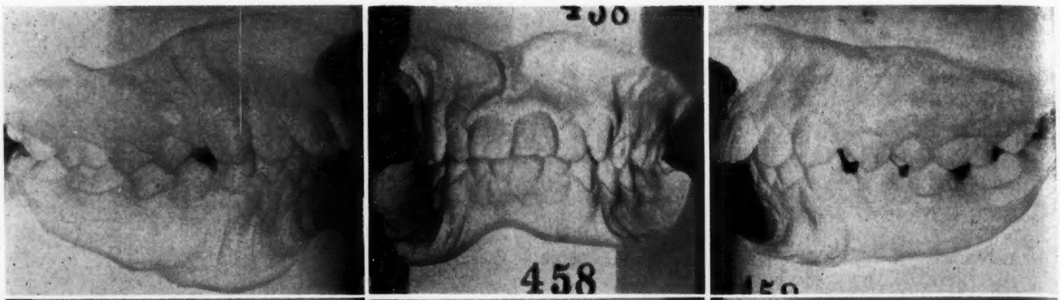
Intraoral and lateral-jaw roentgenograms: The mandibular right central incisor had been given root canal therapy, with questionable success. The third-molar buds were evident in the lateral-jaw film.

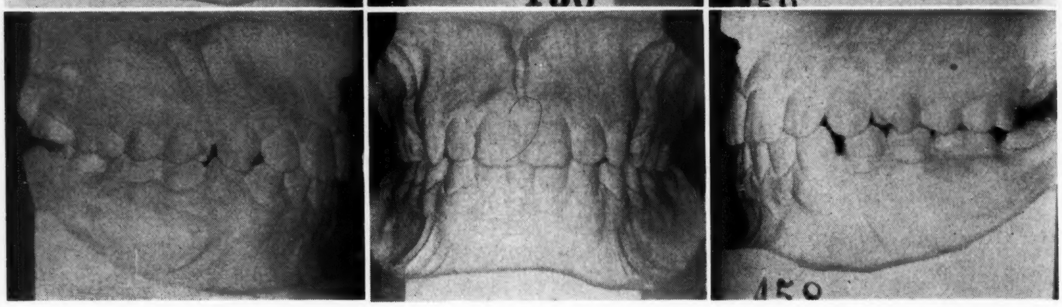
Integration of Preceding Data.—The malocclusion was a Class I (Angle) bimaxillary protrusion complicated by the loss of the mandibular left first molar and subsequent drifting of the adjacent dental units. The deep overbite was aggravated by the loss of the mandibular left first molar.

The objectives of treatment were (1) reduction of the protrusion, (2) re-establishment of good occlusal and proximal dental relationship on the left side, (3) compensation in treatment for the loss of the lower left first molar, and (4) either restoration of the mandibular left central incisor to a state of good health or its removal in orthodontic treatment. In treatment, the maxillary left and right first molars and the mandibular right central incisor were extracted.

CASE 7.—Richard B. was a white boy, 10 years of age (Fig. 7). The medical and dental history was noncontributory with respect to etiological factors in the malocclusion.

A.





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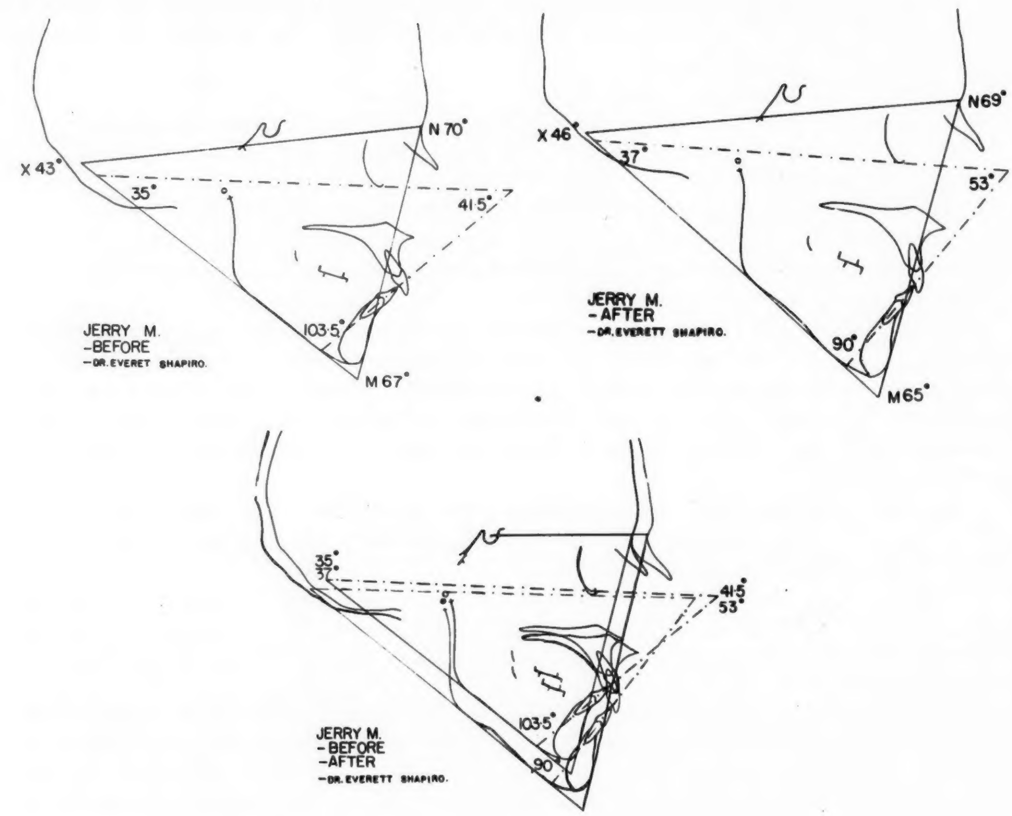
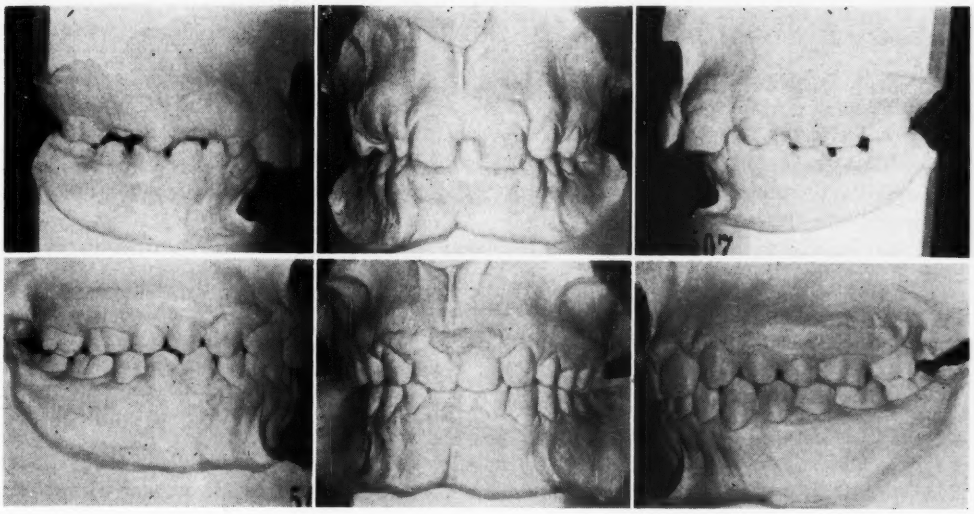


C.

Fig. 6.—Jerry M., Class I bimaxillary dentoalveolar protrusion complicated by the loss of a mandibular first molar and an infected mandibular central incisor. The maxillary first molars and mandibular right central incisor were extracted. *A*, Before treatment; *B*, after treatment; *C*, tracings of lateral cephalic roentgenograms.

A.



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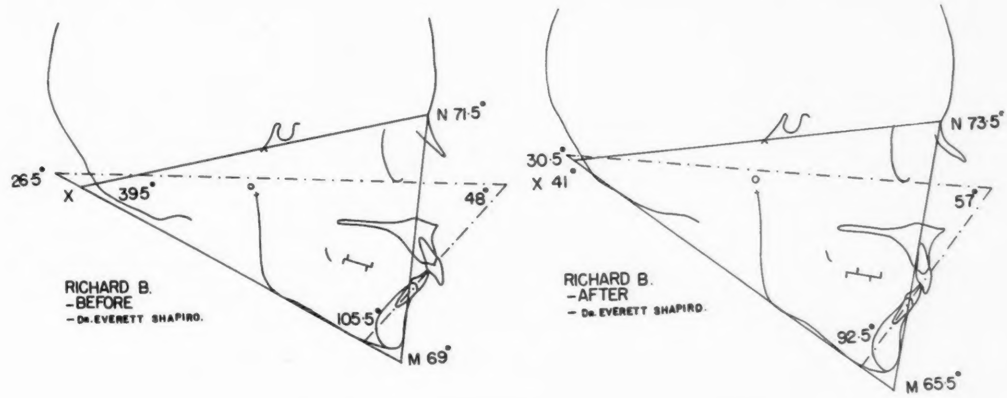
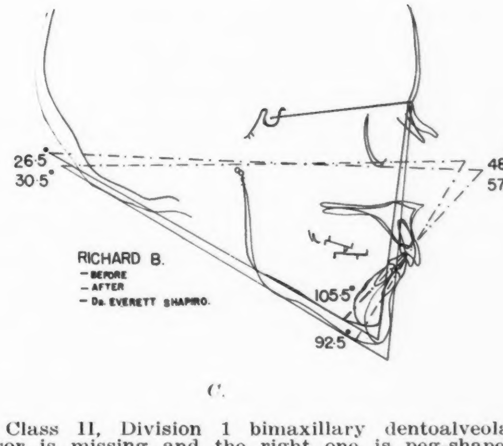




C.

Fig. 7.—Richard B., Class II, Division 1 bimaxillary dentoalveolar protrusion. The maxillary left lateral incisor is missing and the right one is peg-shaped. The peg-shaped lateral incisor was extracted and spaces were closed. *A*, Before treatment; *B*, after treatment; *C*, tracings of lateral cephalic roentgenograms.

Assessment of Orthodontic Records.—

Oriented photographs or visual appraisal: The lips were full and protrusive. The chin was well formed, but it appeared receded because of the prominence of the oral musculature.

Cephalometric analysis:

Cranioskeletal analysis (CSA). The mandible was well oriented anteroposteriorly (angle at N, 71.5 degrees), and there was good ramus height (the mandibular line fell below the base of the occiput, and the Frankfort-mandibular angle was 26.5 degrees).

Dento-cranio-facial orientation (DCO). The dentition was poorly oriented to the face, since the facial line was lingual to the crown of the mandibular incisors. The mandibular incisors were procumbent as well as protrusive, since the mandibular incisor angle was 105.5 degrees and the Frankfort-mandibular incisor angle was 48 degrees.

Orthodontic models: The molar relationship was Class II (Angle), and the maxillary incisors were protrusive (Division 1). The patient had a deep overbite and an excessive overjet. The maxillary left lateral incisor was congenitally missing, and the right lateral incisor was peg-shaped. There was interdental spacing in the posterior mandibular area. The maxillary first premolars were in buccal cross-bite.

Intraoral and lateral-jaw roentgenograms: The intraoral films confirmed the absence of the maxillary left lateral incisor and the peg-shaped condition of the maxillary right lateral incisor. The mandibular third-molar buds were evident, whereas the maxillary third-molar buds were not present.

Integration of Preceding Data.—The patient had a Class II, Division 1 (Angle) bimaxillary dentoalveolar protrusion with some spacing in the posterior mandibular area. The malocclusion was complicated by the absence of the maxillary left lateral incisor and by the peg-shaped maxillary right lateral incisor. Correction of the deep overbite would be simplified if extraction could be avoided in the mandibular arch.

The objectives of treatment were (1) improvement of facial profile, (2) correction of overbite and overjet, and (3) either maintenance of the Class II relationship of the molars and closure of the lateral incisor spaces or achievement of a Class I molar relationship and allowance for prosthetic repair in the maxillary lateral incisor area.

In most instances, closure of spaces in the lateral incisor area is preferable to prosthetic replacement. Most bridgework in the maxillary incisor area is inadequate, and the alignment of the maxillary canines alongside the central incisors is very satisfactory. The mechanics of space closure are simplified when the canines are in Class II relationship.

A few preliminary words to the parent are in order, indicating that (1) esthetics cannot be 100 per cent, (2) some slight spacing may remain, (3) it is necessary to grind the maxillary canines on the proximal, incisal, and labial surfaces, and (4) extraction of two mandibular premolars may be recommended. In the treatment of the malocclusion just described, the peg-shaped incisor was extracted and spaces were closed.

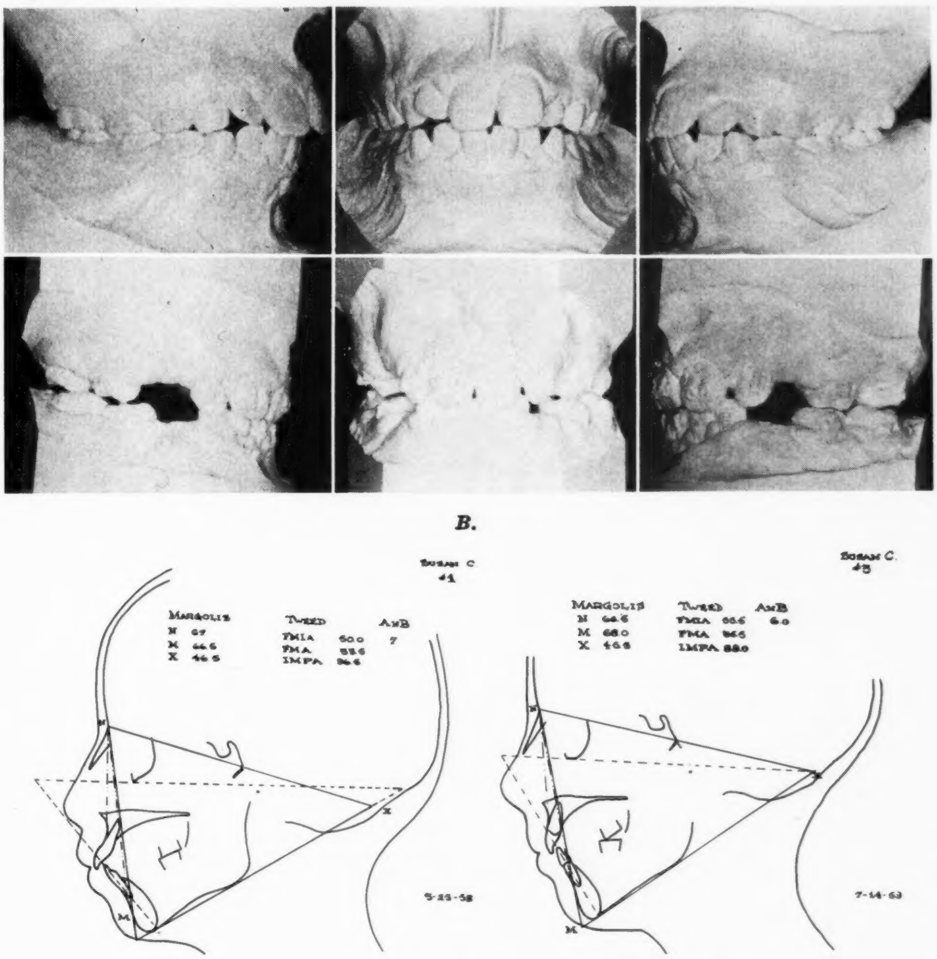
The next two cases were early-treatment cases seen in the orthodontic department of Tufts University Dental School. Dr. Robert Querze administered treatment. Therapy was undertaken in both cases for the following reasons:

1. To reduce a severe protrusion that was harmful to the child and harmful to the dentition.

2. An analysis of each malocclusion indicated that future uncontrolled growth could not help the developing dentition or prevent the extraction of teeth.
3. Treatment would be simplified by holding the maxillary molars posteriorly.

Both patients were 9 years of age, and in both malocclusions the deciduous canines and the deciduous first and second molars were present.

A.



C.

Fig. 8.—Susan C., Class I bimaxillary dentoalveolar protrusion and crowding. The deciduous canines, the first deciduous molars, and the unerupted first premolars were extracted. *A,* Before treatment; *B,* progress one year later; *C,* tracings of lateral cephalic roentgenograms.

CASE 8.—Susan C. was a 9-year-old white girl (Fig. 8). The medical and dental history was noncontributory with respect to etiological factors in the malocclusion.

Assessment of Orthodontic Records.—

Oriented photographs or visual examination: There was some strain about the oral musculature, and the lips were parted in repose. The upper lip was slightly short, and the chin was lacking in prominence.

Cephalometric analysis:

Cranioskeletal analysis (CSA). Chin point (pogonion) was slightly posterior (angle at N, 67 degrees), indicating either a short mandibular body, deficient anterior development, or a retrusive mandible. Ramus height might have been short, since the mandibular line intercepted the base of the occiput. The mandible could be considered small, both in body length and in ramus height. The Frankfort-mandibular angle (33.5 degrees) was larger than normal.

Dento-cranio-facial orientation (DCO). The denture was both protrusive and procumbent. The facial line was almost completely lingual to the mandibular incisor; the mandibular incisor angle was 96.5 degrees, and the Frankfort-mandibular incisor angle was 50 degrees.

Analysis of occlusion from orthodontic models: The molar relationship was Class I (Angle), and there was little overbite and overjet. There was crowding of the maxillary and mandibular incisors. The maxillary lateral incisors were larger than average.

Intraoral and lateral-jaw roentgenograms: There was normal development of all dental units, and third-molar buds were evident in the x-ray films.

Integration of Preceding Data.—The patient had a Class I (Angle) bimaxillary dentoalveolar protrusion and crowding. The minimal overbite and overjet were to be increased with the retraction and uprighting of both maxillary and mandibular incisors. There was apparently excessive tooth material to be accommodated in arches that were comparatively small.

The objectives of treatment were (1) reduction of the protrusion, (2) reduction of the crowding, and (3) maintenance of a Class I relationship of the arches. In the treatment of this malocclusion, the deciduous canines, the deciduous first molars, and the unerupted first premolars were extracted.

CASE 9.—The patient was Arnold G., a 9-year-old white boy (Fig. 9). The medical and dental history was noncontributory so far as etiological factors in the malocclusion were concerned.

Assessment of Orthodontic Records.—

Oriented photographs or visual appraisal: The lips were protrusive and parted in repose. There was strain at mentalis, and a lack of prominence at chin point was evident.

Cephalometric analysis:

Cranioskeletal analysis (CSA). There was good mandibular body development and anteroposterior positioning (angle at N, 71.5 degrees), and ramus height was adequate since the mandibular line fell below the base of the occiput. The Frankfort-mandibular angle (28 degrees) was within normal range.

Dento-cranio-facial orientation (DCO). The facial line intercepted the lingual surface of the cingulum of the mandibular incisors, indicating a protrusive dentition. The incisors were also procumbent, the mandibular incisor angle was 99.5 degrees, and the Frankfort-mandibular incisor angle was 52.5 degrees.

Analysis of occlusion from models: The molars were in Class II (Angle) relationship, and the incisors were protrusive. The overbite was deep, and the overjet was marked. The teeth were well aligned, and there was no interdental spacing. The teeth were of normal size and anatomic form.

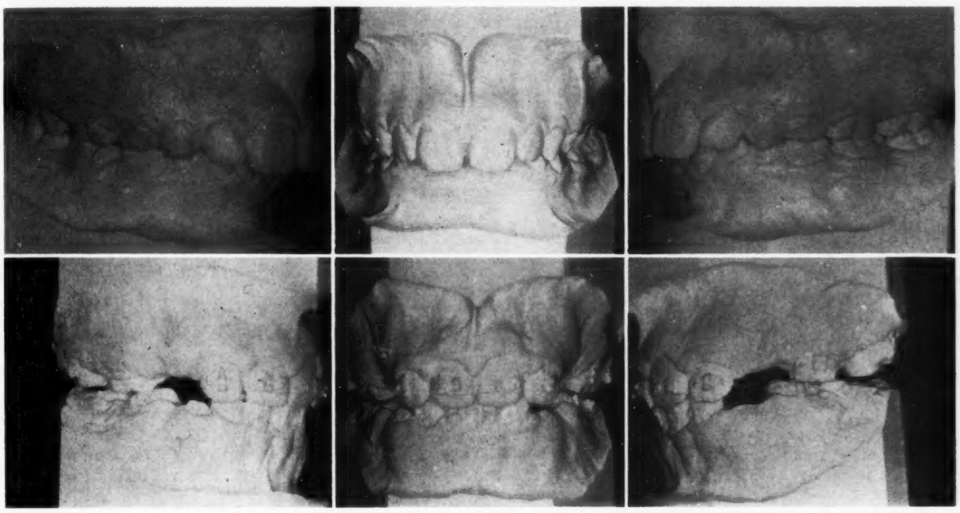
Intraoral and lateral-jaw roentgenograms: There was normal development of canines, premolars, and permanent second molars. The maxillary third-molar buds were not present roentgenographically.

Integration of Preceding Data.—The malocclusion was a Class II, Division 1 (Angle) bimaxillary dentoalveolar protrusion. The teeth were well aligned, but they were procumbent and protrusive. The overbite was deep, and the overjet was moderate.

The objectives of treatment were (1) reduction of the protrusion, (2) correction of the arch relationship, and (3) correction of the deep overbite. Here, again, the deciduous canines, the deciduous first molars, and the underlying first premolars were extracted.

In conclusion, the case analysis is made by means of a general assessment of the child and an evaluation of all the orthodontic records. The analysis does not depend upon any one criterion alone. Neither the cephalometric analysis nor the inclination of the mandibular incisors, for example, can be the sole deciding factor in determining the objectives of treatment, the treatment plan, or the mechanotherapy.

A.



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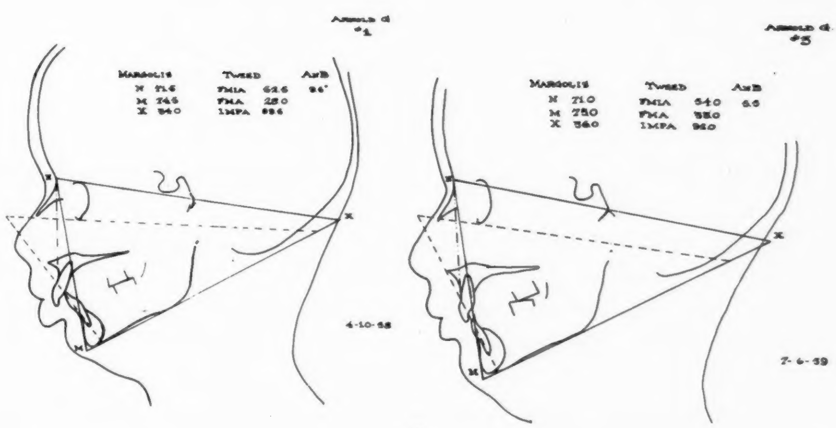

C.

Fig. 9.—Arnold G., Class II, Division 1 bimaxillary dentoalveolar protrusion. The deciduous canines, the first deciduous molars, and the unerupted first premolars were extracted. *A*, Before treatment; *B*, progress one year later; *C*, Tracings of lateral cephalic roentgenograms.

The basic objective of medical or dental therapy should be the improvement of the total patient. If this goal is to be obtained, the total child must be evaluated.

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1146 Beacon St.

CHANGES IN THE ANTERIOR OVERBITE RELATIONSHIP FOLLOWING ORTHDONTIC TREATMENT IN EXTRACTION CASES

JACK M. MAGILL, D.D.S., PHILADELPHIA, PA.

CORRECTION of the excessive anterior overbite is probably one of the most significant objectives in the treatment of malocclusions. This statement is especially true because of the interrelationship that exists between the overbite, function, and oral health. Many believe that deep overbites are causative factors in the production of periodontal disease. Our efforts as orthodontists are therefore constantly directed toward the establishment of an acceptable overbite relationship.

Mershon[48] believed that treatment of deep overbites is instituted because the patient faces the prospect of future oral disease. Miller[49] states that the excessive overbite is a potential danger to the integrity of the arch. Strang,[74, 76] referring to the overbite, says that this is perhaps the most detrimental malrelationship that can exist when considered from the viewpoint of the future oral health and longevity of the dental units. Reid[59] says that, from the periodontal standpoint, failure to reduce the deep overbite is fraught with potential danger. Prakash and Margolis[58] mention that a deep overbite has been assumed to be a causative factor in periodontal disease. Baume[6] and Guerrero[31] discuss the possibility of periodontal lesions resulting from failure to correct the deep overbite during orthodontic treatment.

Although this article deals specifically with the analysis of deep overbites in extraction cases, it should be remembered that the correction of excessive overbites has always been a problem and a source of real concern in nonextraction cases also.

It is worthwhile to take note of a statement by one of the early pioneers in orthodontics, John V. Mershon[48]: "Of all conditions which the dentist encounters, probably the least understood and the most difficult to treat successfully is the closed bite." Prakash and Margolis[58] observe that "excessive overbite is one of the most common problems confronting the orthodontist." Strang[74, 76] sees no reason why excessive overbite should not be as readily analyzed and as successfully treated as any other form of malocclusion, and he teaches that, with proper diagnosis and appliance manipulation, good results can be achieved.

This thesis, which was given as a partial fulfillment of the requirements for certification by the American Board of Orthodontics, is being published with the consent and the recomendation of the Board, but it should be understood that it does not necessarily represent or express the opinion of the Board.

Difficulties in the treatment and stability of the deep overbite have been very great in the past as well as in the present. The literature shows evidence of considerable concern by leading orthodontists concerning the proper approach to the overbite problem. For example, statements concerning the use of the bite plate in treatment appeared as early as 1876, when this appliance was introduced to American dentistry by Norman Kingsley[45]; at that time, however, it was employed mainly to "jump the bite." Case,[16] early in the twentieth century, was using bite plates to correct what he called a "close bite." Later, upon the establishment of appliances attached to dental bands, he felt that this method was obsolete. Guilford[32] also used bite plates for overbite corrections in these early years.

Mershon[48] said that the use of the bite plane to correct deep overbites would result in failure, since elongation of the posterior teeth throws a constant strain on the muscles of mastication and destroys the interrelated harmony of parts. He observed that the only permanent change resulting from the use of the bite plate is depression of the anterior teeth into the alveoli. Hemley,[36] departing from this theory, reported that correction of the deep overbite through use of the bite plate is permanent and is brought about by eruption of the posterior teeth. He claimed that there is no depression of the mandibular incisors.

Waugh[80] feels the Hawley type of bite plate is useful and remarks that nothing gives such satisfactory results as the bite plate, especially when correction of supraclusion of the lower anterior teeth is desired. Hopkins,[39] however, says that although the bite plate opens the bite it has not yet been proved that these teeth are not again depressed when the bite plate is discontinued. Later, Zingesser[85] found that correction of the deep overbite was primarily due to the elevation and tipping of the mandibular buccal units, with no discernible depression of the mandibular incisors. Bahador and Higley,[4] contrary to these findings, found in their study that most of the vertical increase was shown in the posterior region and that the greatest part of this increase was in the maxillary posterior teeth rather than in the mandibular posterior teeth. Porter[57] feels that stability is questionable if an elevation of the posterior teeth results from the use of the bite plate. Graber[28] has said that correction of overbite, with or without the assistance of a bite plate, remains one of the most difficult objectives of treatment with extraoral force alone, probably because of lack of control over the curve of Spee.

In addition to bite plate therapy, other methods have been suggested for the correction of deep overbites. Earlier in this century, Ainsworth,[1] Guilford,[32] and Grieve[30] used inclined planes attached to incisor bands to open the bite. Jones[42] and Steadman[69] advocate a multibanded technique to correct the overbite. Strang[74] says that overbite caused by either supraclusion of the incisors or a combination of supraclusion of the incisors and infraclusion of the posterior teeth is treated by means of the edgewise mechanism for depression of the anterior teeth and elevation of the posterior teeth. Anderson[2] mentions various means besides the bite plate for correcting the overbite. These include banding the teeth and using either the ribbon arch, the edgewise arch, the

twin wire, the pin-and-tube appliance, or the high labial arch wire. Litowitz,[47] after a study of twenty nonextraction cases, concluded that "in cases of deep overbite it was evident that teeth can be depressed by orthodontic procedures. However, such teeth return to at least their original height in every case; in some, they exceed it."

Walter,[79] in a study of thirty-four nonextraction cases treated by Allan G. Brodie, Chester F. Wright, and graduate students at the University of Illinois, found a decrease in overbite after therapy in thirty-two cases. Following retention, the overbites in these thirty-two cases increased by an average of 0.71 mm. However, the overbites were all less than before treatment. Wylie[83] observed that in some cases the full amount of vertical development permitted by the musculature is not obtained. The latter cases offer the best prognosis for orthodontic or reconstructive procedures.

It should be remembered that the foregoing statements were not necessarily made with extraction treatment in mind. The problems associated with overbite correction and subsequent relapse were with us long before the advent of routine extraction treatment. Many clinical orthodontists, as well as many research workers, look with a critical eye on the removal of teeth in deep-overbite cases. Such treatment, it is felt, can only increase the excessive anterior overbite relationship. Cole[20] came to the conclusion that "treatment involving extraction tends to increase the overbite . . . probably due to the more forward positioning of the molars." He also made the statement that "overbite reduced by treatment tends to return." Brodie,[12] commenting on this study by Cole, wrote: "This study focused attention on a matter that had been ignored by the proponents of extraction, viz., the overbite. A deep overbite had long been held to have a deleterious effect on the denture. Here was shown the fact that without exception no correction took place in the overbite, and in 62% the overbite was increased."

Heide,[34] discussing Class II, Division 2 cases, said: "Every possible effort must be made in this type of malocclusion to avoid sacrifice of lower bicuspids when formulating a treatment plan, because of the strong danger of later relapse of the corrected overbite." Graber[29] voices concern in any Class II case with extraction in the lower arch, fearing relapsing overbite. Guerrero[31] states that the majority of cases in which four premolars are extracted result in deep overbites. Reid[59] makes the observation that the removal of premolars in treatment tends to increase the overbite. Brodie,[13] in discussing diagnostic problems, wrote: "They are also finding difficulty in maintaining contact at the site of extraction and they are almost invariably having difficulty in maintaining a reduced overbite." Baume,[6] discussing physiologic tooth migration, stated: "The present data may serve as a warning against the recent trend in the field of orthodontics to remove permanent teeth in the mandibular arch without considering its effect on the incisal overbite."

Nevertheless, Stackler[66] made a study of twenty four-premolar-extraction cases and found that only three of the twenty showed a loss of vertical dimension and an overbite that could be considered excessive; in each case, however, the overbite was not so severe as initially although it was excessive enough to

arouse concern. Stackler concluded that "deep overbite occurred in this sample, but the evidence did not appear to be conclusive." Similar statements describe the creation of deep overbites in extraction cases, even in those malocclusions in which none existed initially.

The vast amount of literature and the various shades of opinion concerning the behavior of overbite following treatment emerge as an issue that serves as a remarkable springboard from which comparisons, methods, and general observations can be made. Among the many issues raised concerning the overbite, one of the most challenging is the effect of extraction treatment on the overbite, both after active treatment and several years after retention is discontinued. In undertaking this study it was felt that those completed cases that yielded the best possible results after treatment would serve as an ideal source of material from which to observe the changes in the anterior overbite relationship.

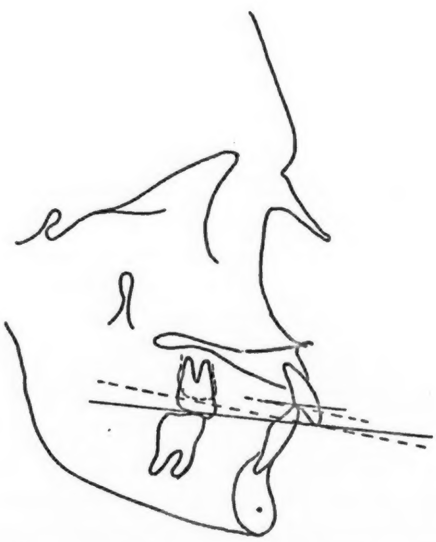


Fig. 1.—Variations in the measured overbite attributed to the position of the occlusal plane. Note downward tilting of the occlusal plane simulating opening of the bite during treatment. This position of the occlusal plane yields smaller anterior overbite measurements. A line is drawn at the mandibular incisal edge parallel to the occlusal plane and the vertical distance between the two lines is measured.

METHODS AND MATERIALS

Discussion.—Numerous methods of measuring the overbite have been presented in orthodontic publications. However, they are all derived from records obtained through the use of plaster casts or cephalometric x-rays. Steadman[71] used the x-ray apparatus as a means of obtaining a frontal x-ray registration of dental casts in studying the anterior overbite. Walter,[79] Peak,[54] Baume,[6] and Goldstein and Stanton[26] also investigated the behavior of the overbite through measurements obtained from plaster casts.

More recently, the cephalometer has been employed to measure overbite relationships. Cole,[20] using cephalometric head plates, measured the distance between the incisal edges of the maxillary and mandibular incisors. Björk,[9]

employing the profile x-ray (Fig. 1), drew a line from the distal cusp of the maxillary first molar to the incisal edge of the maxillary central incisor. He then measured the vertical distance to the incisal edge of the mandibular central incisor.

Although the occlusal plane has been used successfully, its cant can be changed during treatment, thus affecting the anterior overbite calculations.

Prakash and Margolis[58] drew the facial plane and, from it, two perpendicular lines to the incisal edges of the incisors (Fig. 2). Despite the fact that the facial plane adds to the simplicity of the measuring process, any changes in position of pogonion during treatment can alter the overbite measurement.

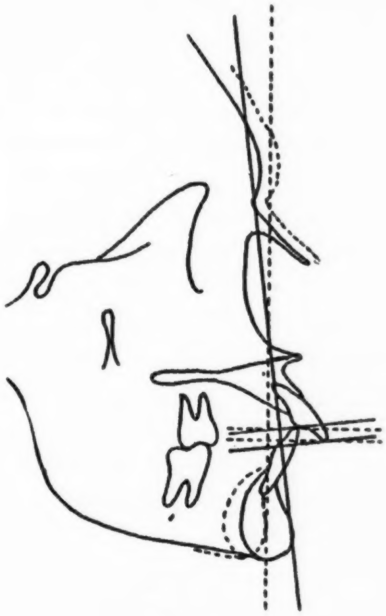


Fig. 2.

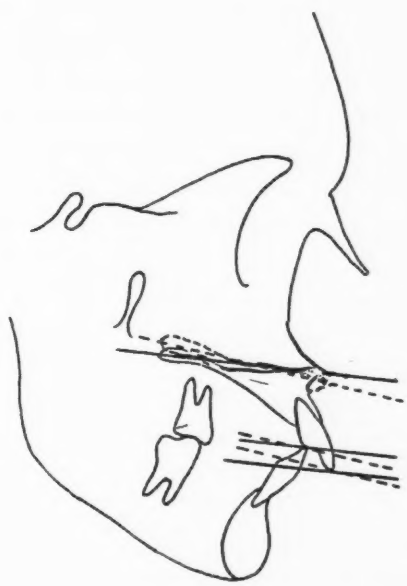


Fig. 3.

Fig. 2.—Variations in the measured overbite attributed to the position of the facial plane. The more perpendicular the facial plane, the larger will be the measured overbite. The greater the retrusion of the mandible, the smaller the measured overbite. The more parallel the maxillary incisor is to the facial plane, the larger the measured overbite. The greater the procumbency of the incisors to the facial plane, the smaller the measured overbite.

Fig. 3.—Variations in the measured overbite attributed to the position of the palatal plane. Although the palatal plane does not change its angular position during treatment as does the occlusal plane, still there are similar variations as with other methods; that is the greater the labial axial inclination of the maxillary incisors, the smaller the overbite, and the more perpendicular the incisors to the palatal plane, the greater the measured overbite.

Although there are varying degrees of discrepancy in all methods used to measure the overbite, the palatal plane (Fig. 3), as suggested by Sassouni,[63] serves well as a base of orientation. There appear to be minimal changes in this area during treatment. Also, this plane of orientation yields a larger numerical dimension of the measured overbite as compared to other planes; consequently, the effect of small inaccuracies in measurement on the final result of the study is reduced. Dental casts should yield results comparable to the occlusal plane as derived from the cephalometric x-ray, since the occlusal plane of the casts is parallel to a horizontal surface. It was decided that

all four reference planes mentioned should be used to make certain that the results in this study would not be unduly influenced by any single method of measurement.

TECHNIQUE OF MEASURING OVERBITE

Graph paper divided horizontally and vertically into millimeters, as suggested by Sassouni,[62] was used to measure the anterior overbite. Relationships were established by superimposing the graph paper on the illuminated cephalometric x-ray. Small perforations in the x-ray pictures were used as markers to designate the position of the anterior nasal spine, the posterior nasal spine, and the incisal edges and root apices of the maxillary and mandibular central incisors. This procedure was applied to the 189 profile head plates used in this study.

Orienting to the Palatal Plane (Fig. 3).—The graph paper was superimposed on the illuminated x-ray film, and a horizontal line was passed through the palatal plane as represented by the perforations. The vertical distance between the maxillary and mandibular incisal edges was read directly to the nearest 0.25 mm.

Orienting to the Facial Plane (Fig. 2).—To register the overbite with reference to the facial plane, a vertical line on the graph paper was superimposed through both nasion and pogonion. The vertical distance between the incisal edges was read.

Orienting to the Occlusal Plane (Fig. 1).—When the occlusal plane was used as the origin of reference, the graph paper was placed so that a horizontal line was tangent to the distal cusp of the maxillary first molar and the incisal edge of the maxillary central incisor. The vertical distance to the mandibular central incisal edge was read directly from the horizontal lines on the graph paper.

Apex-to-Apex Measurement (Fig. 4).—The vertical distance between the apices of the maxillary and mandibular central incisors was made measurable by a line drawn through the long axis of these two teeth on the original x-ray film. A pin-point perforation was placed at their respective apices. The graph paper was placed with a vertical line coinciding with the long axis of the maxillary incisor, and the total crown-root length of this tooth was read to the nearest quarter of a millimeter. The length of the mandibular central incisor was similarly recorded. It was then necessary to establish the same crown-root length for the maxillary and mandibular incisors after treatment and after retention. This measurement was obtained by drawing a line through the long axis of the maxillary and mandibular central incisors on the cephalometric x-ray pictures taken after treatment and after retention. The same procedure was followed for each patient. The graph paper was then superimposed on the x-ray film, with a vertical line through the established long axis and a perforation placed to indicate the same length as originally recorded. The length of the maxillary central incisor before and after treatment and after retention was rendered the same to the nearest quarter of a millimeter. This procedure was also used for the mandibular central incisors.

Finally, for measurement of the vertical distance between the two root apices of the upper and lower central incisors, a horizontal line on the graph paper was superimposed on the palatal plane and the vertical distance between the apices on the original roentgenogram was noted. The same measurement was made on the roentgenograms taken after treatment and after retention. The differences, as compared to the original measurements, were recorded.

The overbite calculations from the dental casts were made by means of a surface gauge with the teeth in occlusion and parallel to a horizontal plane. The difference in distance between the maxillary and mandibular incisal edges was recorded.

This study consists of 189 cephalometric roentgenograms, together with the same number of plaster casts taken before treatment, after treatment, and following retention. Sixty-three orthodontic patients with favorable end results were examined. Facial photographs in all three phases were made but not included in this study. A total of 1,512 measurements were made and yielded 882 recorded units from which the tables and charts were assembled. All cases were derived from my practice, and in each case the four premolars were extracted. The appliance used was the edgewise arch mechanism, with several auxiliaries.

The malocclusions studied were divided into two groups; thirty-four patients were in the Class II category and twenty-nine patients belonged to Class I.

CHANGES IN INCISAL OVERBITE BEFORE AND AFTER TREATMENT AND AFTER RETENTION

Group Average I. Average Calculations Representing Typical Changes in the Incisal Overbite of Sixty-three Cases Before and After Treatment and After Retention

PLANE OF ORIENTATION	BEFORE TREATMENT	AFTER TREATMENT	AFTER RETENTION
Palatal plane	5.85	3.37	4.08
Casts	4.90	2.73	3.04
Facial plane	5.28	3.16	3.83
Occlusal plane	4.37	2.71	3.23
Apex-to-apex		5.3	4.2

Orientation of the anterior overbite to the palatal plane in all sixty-three cases revealed an average overbite before treatment of 5.85 mm. (Table I and Group Average I); after treatment, this overbite was reduced to an average of 3.37 mm. These figures reveal a decrease of 2.48 mm., or 42 per cent, which appears to be a result of treatment. A summary of individual cases (Summary I) shows that sixty-one of the corrected malocclusions (97 per cent) had less of an overbite after treatment. In the remaining two cases the overbites were increased by relatively insignificant amounts—a slight 0.25 mm. in one case and 0.50 mm. in the other (Table VI). Although after retention the overbites of forty-six patients showed an increase as compared to after-treatment findings, still fifty-four patients (85 per cent) had significantly less overbite than when treatment began (Summary I).

Table I. Individual Measurements Representing Changes in Anterior Overbite in Sixty-Three Cases Before Treatment, After Treatment, and Subsequent to Retention

CASE NO.	PALATAL PLANE			CASTS			FACIAL PLANE			OCCLUSAL PLANE			APEX-TO-APEX	
	B	A	AR	B	A	AR	B	A	AR	B	A	AR	A	AR
1	5.00	3.00	4.00	5.00	3.25	3.00	4.00	3.25	3.75	3.25	3.00	3.00	7.0	6.5
2	6.50	2.75	3.75	5.75	1.00	2.50	6.25	2.25	3.25	5.75	1.75	2.50	5.0	5.5
3	8.25	4.25	4.50	7.75	2.00	3.50	7.00	4.25	4.00	6.00	3.75	3.75	5.0	4.5
4	6.25	3.00	3.00	5.00	2.75	2.25	6.00	2.75	3.25	5.00	2.50	2.75	7.5	7.5
5	7.00	4.00	5.25	5.50	2.50	4.00	5.75	3.25	5.00	5.25	3.00	4.25	4.5	3.5
6	3.25	2.75	4.00	3.50	2.00	2.75	3.25	2.75	4.25	2.25	2.00	3.50	5.0	3.0
7	5.00	2.25	4.00	3.50	1.25	2.50	4.00	2.00	3.75	3.25	1.75	3.00	4.0	3.0
8	7.00	3.75	3.50	4.25	3.25	2.25	5.25	3.00	3.00	4.50	3.00	2.25	7.0	6.0
9	7.25	4.00	4.00	5.25	3.00	2.50	6.00	3.50	3.50	5.00	3.25	3.25	6.0	5.0
10	6.25	4.00	5.00	5.25	2.50	3.75	6.25	3.25	4.75	5.00	3.00	3.75	4.5	3.0
11	3.00	2.50	3.25	2.25	2.00	3.50	3.00	2.50	2.75	2.50	2.00	2.50	3.0	2.0
12	3.50	2.00	4.00	5.50	2.75	4.75	3.00	1.50	3.50	2.25	1.25	3.00	4.0	-1.0
13	2.50	1.25	4.00	2.75	2.50	2.50	2.25	1.25	3.50	2.00	0.75	3.00	3.5	1.0
14	6.00	3.00	5.00	4.50	2.25	3.00	5.75	2.75	5.00	4.25	2.25	4.00	6.0	3.5
15	3.50	2.00	2.50	4.25	1.25	1.00	3.25	1.75	2.50	2.50	1.00	1.75	6.0	5.0
16	5.00	3.75	3.75	4.50	2.25	3.75	4.25	3.50	3.50	3.75	3.00	3.00	1.0	1.0
17	4.00	3.00	3.25	3.75	3.00	2.50	4.00	2.75	3.50	3.25	2.50	3.00	3.5	3.5
18	5.25	3.25	5.00	4.50	2.00	3.75	4.75	3.00	4.50	3.50	2.25	3.25	4.0	2.0
19	3.00	2.25	3.00	4.00	2.00	1.75	2.75	2.00	2.00	2.50	2.00	2.00	0.0	-2.0
20	6.50	2.25	2.25	6.50	2.50	2.25	6.00	2.25	2.25	5.25	2.00	2.25	4.0	2.5
21	7.00	3.25	4.00	10.00	2.25	4.00	6.00	3.25	4.00	5.00	3.00	3.50	4.0	4.0
22	8.50	2.25	4.00	7.00	2.25	2.25	7.25	2.25	4.25	5.75	2.00	3.50	10.5	9.0
23	5.25	1.75	3.50	4.50	1.50	1.75	4.75	1.75	3.25	4.25	1.50	2.75	7.5	6.5
24	8.25	3.00	5.25	6.00	4.00	4.25	7.75	3.00	5.00	6.50	2.25	4.25	5.5	3.0
25	5.75	3.00	2.25	5.00	3.00	2.00	4.75	2.75	1.75	4.25	2.00	1.00	5.0	5.5
26	6.75	3.00	4.00	4.00	2.00	3.00	6.50	2.75	3.50	5.25	2.25	2.50	6.0	3.0
27	4.50	3.00	4.25	3.25	1.25	2.25	4.00	2.50	3.75	3.00	1.75	2.50	5.0	3.5
28	7.25	4.50	4.25	5.25	3.25	3.50	6.25	4.25	4.00	5.50	4.00	3.25	6.0	6.0
29	5.25	3.50	4.00	3.50	3.00	3.25	5.00	3.50	4.00	4.50	3.00	3.50	6.0	5.5
30	5.25	4.25	3.75	4.25	3.25	1.75	4.50	4.00	3.25	3.50	3.25	3.00	4.5	3.5
31	5.25	3.25	2.00	3.75	2.50	1.50	4.75	3.00	1.50	3.75	2.50	1.00	7.5	8.5
32	5.25	4.00	4.75	4.00	3.25	2.25	5.00	4.00	4.50	4.00	3.25	3.75	7.0	5.0
33	3.50	3.25	3.00	3.25	3.00	2.25	3.00	3.00	2.50	2.75	2.75	2.50	1.0	1.0
34	3.50	3.75	5.25	1.25	2.25	3.00	3.00	3.75	5.00	2.00	3.25	4.00	3.5	3.0
35	5.00	2.25	4.50	4.00	2.00	3.75	4.75	2.00	4.25	4.25	1.75	3.25	5.5	1.5
36	7.00	6.75	5.00	7.00	4.75	4.50	6.50	6.25	4.50	5.75	5.75	4.25	2.5	4.5
37	8.00	5.25	6.25	6.75	4.50	5.50	7.25	5.00	6.00	6.25	4.25	4.50	9.5	7.5
38	7.75	2.25	2.25	6.00	1.25	1.00	6.25	2.00	2.25	5.25	1.50	2.00	8.0	8.0
39	7.00	5.25	5.50	5.25	3.50	4.00	6.75	5.00	5.75	5.50	4.50	4.75	5.0	4.0
40	6.25	4.25	5.00	6.75	3.50	4.75	6.00	4.25	5.00	4.25	3.50	3.75	2.5	1.5
41	7.50	3.50	4.00	6.00	1.75	2.00	7.00	3.25	3.25	5.50	3.00	3.00	2.5	2.5
42	6.00	4.75	5.25	4.25	4.25	4.00	4.75	4.50	5.00	3.75	4.00	4.50	6.5	5.5
43	7.25	4.25	4.75	7.50	5.00	4.50	6.50	4.25	5.00	5.50	4.00	4.25	8.0	6.5
44	7.25	5.00	4.25	4.25	4.00	3.25	6.25	4.75	4.25	5.25	4.50	3.75	6.5	5.5
45	5.50	2.00	2.50	4.25	3.00	2.50	5.25	1.75	2.25	4.50	1.25	1.50	7.0	6.5
46	5.25	4.00	5.50	4.00	2.25	3.50	4.50	3.75	5.00	3.75	3.00	4.25	5.0	2.0
47	7.25	3.25	4.50	4.75	2.00	3.75	6.75	3.50	4.25	5.50	3.00	3.75	4.5	4.5
48	7.50	3.00	3.75	5.00	3.75	2.75	7.00	3.00	3.50	5.25	2.50	3.25	10.5	9.5
49	5.50	2.00	2.25	5.00	3.00	2.50	5.25	1.50	1.50	4.00	1.50	1.25	6.0	5.5
50	4.25	2.25	2.25	6.00	2.00	2.25	4.25	2.25	2.50	3.75	2.00	2.00	3.5	2.5
51	7.00	2.75	3.75	5.25	2.00	3.25	6.75	2.50	3.75	5.75	2.00	3.25	5.5	4.5
52	6.00	3.75	4.75	3.75	3.75	3.25	5.25	3.25	4.50	4.50	3.00	4.00	6.0	4.5
53	4.50	4.25	5.00	5.50	3.50	3.25	4.50	4.25	5.25	4.25	3.50	4.75	1.0	0.5
54	9.25	4.00	3.25	5.00	3.25	2.50	8.25	4.00	3.50	6.50	3.50	3.25	5.0	5.0
55	7.25	4.00	5.50	6.75	2.75	3.00	7.50	4.00	5.25	6.75	3.50	5.00	4.0	3.5
56	6.00	2.00	4.50	4.00	2.75	2.25	4.50	1.50	4.00	3.75	1.25	3.50	9.0	5.5
57	3.50	4.00	5.00	2.50	3.00	3.50	2.75	3.50	4.25	2.00	3.00	4.00	4.5	3.0
58	6.00	3.75	4.50	6.25	3.00	4.00	5.50	3.25	4.50	5.00	3.00	4.00	6.0	5.0
59	5.75	4.00	4.50	5.00	3.00	4.00	5.50	4.00	4.25	4.25	3.25	4.00	6.0	5.5
60	6.00	4.75	4.75	4.50	4.00	3.00	6.00	4.50	4.50	4.25	3.75	3.50	6.5	5.5
61	5.50	3.75	5.00	5.00	2.50	3.75	5.50	3.75	4.25	4.50	3.00	3.25	5.0	4.0
62	7.50	2.00	3.50	5.50	1.00	2.50	6.00	2.00	3.25	5.00	1.50	2.25	8.0	7.0
63	5.00	4.50	4.50	4.75	4.00	4.25	4.50	4.25	4.25	4.00	3.75	3.75	2.0	3.0
AVERAGE	5.85	3.37	4.08	4.90	2.73	3.04	5.28	3.16	3.83	4.37	2.71	3.23	5.3	4.2

B = Before treatment.
A = After treatment.
AR = After retention.

SUMMARY I. A SUMMARY OF SIXTY-THREE INDIVIDUAL CASES FROM TABLE I SHOWING CHANGES IN INCISAL OVERBITE BEFORE AND AFTER TREATMENT AND FOLLOWING RETENTION

	CASES OF OVERBITE LESS	CASES OF OVERBITE MORE	CASES OF OVERBITE SAME
Palatal plane			
A compared with B	61	2	0
AR compared with B	54	8	1
AR compared with A	9	46	8
Casts			
A compared with B	60	2	1
AR compared with B	60	3	0
AR compared with A	26	35	2
Facial plane			
A compared with B	60	2	1
AR compared with B	56	7	0
AR compared with A	9	45	9
Occlusal plane			
A compared with B	58	3	2
AR compared with B	54	8	1
AR compared with A	11	44	8
Apex-to-apex			
A compared with B	62	0	1
AR compared with B	61	2	0
AR compared with A	5	48	10

B = Before treatment.
A = After treatment.
AR = After retention.

The average settling of the overbite from the period after treatment to that after retention amounted to 0.71 mm. Nevertheless, when the original overbite before treatment was compared to the existing overbite after retention, a decrease of 1.77 mm. in the anterior overbite was noted. This is an average of all patients studied (Group Average I).

The results obtained from overbite measurements using the facial or occlusal plane are approximately the same as the figures derived from the palatal-plane measurements. The most favorable overbite results were derived from measurements of the dental casts. This method of measurement revealed that sixty patients, or 95 per cent of the total, had a smaller measured overbite after retention than when treatment began. The dental casts also disclosed that following retention not all cases settle beyond the overbite position after treatment. Summary I shows that in twenty-six cases the overbite relationship was actually less after retention than after treatment.

A more realistic interpretation of what happens to the position of the anterior teeth and the incisal overbite can be found by measuring the vertical difference between the root apices of the maxillary and mandibular incisors before and after treatment and following retention. It is understood that the simple reduction of the procumbent maxillary and mandibular incisors, without any special effort to depress them, will increase the overbite. It is necessary, therefore, to incorporate anterior depression modifications in all arch wires in order to help reduce the overbite. The apex-to-apex measurements in the examination of these records show an average interapical increase of 5.3 mm. after treatment,

Group Average II. Average Calculations Representing Typical Changes in the Incisal Overbite of Twenty-nine Cases in the Class I Category Before and After Treatment and After Retention

PLANE OF ORIENTATION	BEFORE TREATMENT	AFTER TREATMENT	AFTER RETENTION
Palatal plane	5.15	3.44	3.98
Casts	4.53	2.90	3.09
Facial plane	4.79	3.21	3.68
Occlusal plane	3.44	2.72	3.11
Apex-to-apex		4.5	3.5

Group Average III. Average Calculations Representing Typical Changes in the Incisal Overbite of Thirty-four Cases in Class II Category Before and After Treatment and After Retention

PLANE OF ORIENTATION	BEFORE TREATMENT	AFTER TREATMENT	AFTER RETENTION
Palatal plane	6.46	3.30	4.17
Casts	5.22	2.58	3.00
Facial plane	5.70	3.12	3.96
Occlusal plane	4.74	2.70	3.32
Apex-to-apex		5.9	4.8

Table II. Individual Measurements Representing Changes in Anterior Overbite in Twenty-nine Class I Cases Before Treatment, After Treatment, and Subsequent to Retention

CASE NO.	CLASS I PALATAL PLANE			CLASS I CASTS			CLASS I FACIAL PLANE			CLASS I OCCLUSAL PLANE			CLASS I APEX-TO-APEX	
	B	A	AR	B	A	AR	B	A	AR	B	A	AR	A	AR
4	6.25	3.00	3.00	5.00	2.75	2.25	6.00	2.75	3.25	5.00	2.50	2.75	7.5	7.5
10	6.25	4.00	5.00	5.25	2.50	3.75	6.25	3.25	4.75	5.00	3.00	3.75	4.5	3.0
11	3.00	2.50	3.25	2.25	2.00	3.50	3.00	2.50	2.75	2.50	2.00	2.50	3.0	2.0
12	3.50	2.00	4.00	5.50	2.75	4.75	3.00	1.50	3.50	2.25	1.25	3.00	4.0	-1.0
13	2.50	1.25	4.00	2.75	2.50	2.50	2.25	1.25	3.50	2.00	0.75	3.00	3.5	1.0
14	6.00	3.00	5.00	4.50	2.25	3.00	5.75	2.75	5.00	4.25	2.25	4.00	6.0	3.5
16	5.00	3.75	3.75	4.50	2.25	3.75	4.25	3.50	3.50	3.75	3.00	3.00	1.0	1.0
17	4.00	3.00	3.25	3.75	3.00	2.50	4.00	2.75	3.50	3.25	2.50	3.00	3.5	3.5
25	5.75	3.00	2.25	5.00	3.00	2.00	4.75	2.75	1.75	4.25	2.00	1.00	5.0	5.5
29	5.25	3.50	4.00	3.50	3.00	3.25	5.00	3.50	4.00	4.50	3.00	3.50	6.0	5.5
30	5.25	4.25	3.75	4.25	3.25	1.75	4.50	4.00	3.25	3.50	3.25	3.00	4.5	3.5
31	5.25	3.25	2.00	3.75	2.50	1.50	4.75	3.00	1.50	3.75	2.50	1.00	7.5	8.5
32	5.25	4.00	4.75	4.00	3.25	2.25	5.00	4.00	4.50	4.00	3.25	3.75	7.0	5.0
33	3.50	3.25	3.00	3.25	3.00	2.25	3.00	3.00	2.50	2.75	2.75	2.50	1.0	1.0
35	5.00	2.25	4.50	4.00	2.00	3.75	4.75	2.00	4.25	4.25	1.75	3.25	5.5	1.5
36	7.00	6.75	5.00	7.00	4.75	4.50	6.50	6.25	4.50	5.75	5.75	4.25	2.5	4.5
40	6.25	4.25	5.00	6.75	3.50	4.75	6.00	4.25	5.00	4.25	3.50	3.75	2.5	1.5
41	7.50	3.50	4.00	6.00	1.75	2.00	7.00	3.25	3.25	5.50	3.00	3.00	2.5	2.5
45	5.50	2.00	2.50	4.25	3.00	2.50	5.25	1.75	2.25	4.50	1.25	1.50	7.0	6.5
46	5.25	4.00	5.50	4.00	2.25	3.50	4.50	3.75	5.00	3.75	3.00	4.25	5.0	2.0
49	5.50	2.00	2.25	5.00	3.00	2.50	5.25	1.50	1.50	4.00	1.50	1.25	6.0	5.5
50	4.25	2.25	2.25	6.00	2.00	2.25	4.25	2.25	2.50	3.75	2.00	2.00	3.5	2.5
52	6.00	3.75	4.75	3.75	3.75	3.25	5.25	3.25	4.50	4.50	3.00	4.00	6.0	4.5
53	4.50	4.25	5.00	5.50	3.50	3.25	4.50	4.25	5.25	4.25	3.50	4.75	1.0	0.5
57	3.50	4.00	5.00	2.50	3.00	3.50	2.75	3.50	4.25	2.00	3.00	4.00	4.5	3.0
59	5.75	4.00	4.50	5.00	3.00	4.00	5.50	4.00	4.25	4.25	3.25	4.00	6.0	5.5
60	6.00	4.75	4.75	4.50	4.00	3.00	6.00	4.50	4.50	4.25	3.75	3.50	6.5	5.5
61	5.50	3.75	5.00	5.00	2.50	3.75	5.50	3.75	4.25	4.50	3.00	3.25	5.0	4.0
63	5.00	4.50	4.50	4.75	4.00	4.25	4.50	4.25	4.25	4.00	3.75	3.75	2.0	3.0
Average	5.15	3.44	3.98	4.53	2.90	3.09	4.79	3.21	3.68	3.44	2.72	3.11	4.5	3.5

B = Before treatment.
A = After treatment.
AR = After retention.

TABLE III. INDIVIDUAL MEASUREMENTS REPRESENTING CHANGES IN ANTERIOR OVERBITE IN THIRTY-FOUR CLASS II CASES BEFORE TREATMENT, AFTER TREATMENT, AND SUBSEQUENT TO RETENTION

CASE NO.	CLASS II PALATAL PLANE			CLASS II CASTS			CLASS II FACIAL PLANE			CLASS II OCCLUSAL PLANE			CLASS II APEX-TO-APEX	
	B	A	AR	B	A	AR	B	A	AR	B	A	AR	A	AR
1	5.00	3.00	4.00	5.00	3.25	3.00	4.00	3.25	3.75	3.25	3.00	3.00	7.0	6.5
2	6.50	2.75	3.75	5.75	1.00	2.50	6.25	2.25	3.25	5.75	1.75	2.50	5.0	5.5
3	8.25	4.25	4.50	7.75	2.00	3.50	7.00	4.25	4.00	6.00	3.75	3.75	5.0	4.5
5	7.00	4.00	5.25	5.50	2.50	4.00	5.75	3.25	5.00	5.25	3.00	4.25	4.5	3.5
6	3.25	2.75	4.00	3.50	2.00	2.75	3.25	2.75	4.25	2.25	2.00	3.50	5.0	3.0
7	5.00	2.25	4.00	3.50	1.25	2.50	4.00	2.00	3.75	3.25	1.75	3.00	4.0	3.0
8	7.00	3.75	3.50	4.25	3.25	2.25	5.25	3.00	3.00	4.50	3.00	2.25	7.0	6.0
9	7.25	4.00	4.00	5.25	3.00	2.50	6.00	3.50	3.50	5.00	3.25	3.25	6.0	5.0
15	3.50	2.00	2.50	4.25	1.25	1.00	3.25	1.75	2.50	2.50	1.00	1.75	6.0	5.0
18	5.25	3.25	5.00	4.50	2.00	3.75	4.75	3.00	4.50	3.50	2.25	3.25	4.0	2.0
19	3.00	2.25	3.00	4.00	2.00	1.75	2.75	2.00	2.00	2.50	2.00	2.00	0.0	-2.0
20	6.50	2.25	2.25	6.50	2.50	2.25	6.00	2.25	2.25	5.25	2.00	2.25	4.0	2.5
21	7.00	3.25	4.00	10.00	2.25	4.00	6.00	3.25	4.00	5.00	3.00	3.50	4.0	4.0
22	8.50	2.25	4.00	7.00	2.25	2.25	7.25	2.25	4.25	5.75	2.00	3.50	10.5	9.0
23	5.25	1.75	3.50	4.50	1.50	1.75	4.75	1.75	3.25	4.25	1.50	2.75	7.5	6.5
24	8.25	3.00	5.25	6.00	4.00	4.25	7.75	3.00	5.00	6.50	2.25	4.25	5.5	3.0
26	6.75	3.00	4.00	4.00	2.00	3.00	6.50	2.75	3.50	5.25	2.25	2.50	6.0	3.0
27	4.50	3.00	4.25	3.25	1.25	2.25	4.00	2.50	3.75	3.00	1.75	2.50	5.0	3.5
28	7.25	4.50	4.25	5.25	3.25	3.50	6.25	4.25	4.00	5.50	4.00	3.25	6.0	6.0
34	3.50	3.75	5.25	1.25	2.25	3.00	3.00	3.75	5.00	2.00	3.25	4.00	3.5	3.0
37	8.00	5.25	6.25	6.75	4.50	5.50	7.25	5.00	6.00	6.25	4.25	4.50	9.5	7.5
38	7.75	2.25	2.25	6.00	1.25	1.00	6.25	2.00	2.25	5.25	1.50	2.00	8.0	8.0
39	7.00	5.25	5.50	5.25	3.50	4.00	6.75	5.00	5.75	5.50	4.50	4.75	5.0	4.0
42	6.00	4.75	5.25	4.25	4.25	4.00	4.75	4.50	5.00	3.75	4.00	4.50	6.5	5.5
43	7.25	4.25	4.75	7.50	5.00	4.50	6.50	4.25	5.00	5.50	4.00	4.25	8.0	6.5
44	7.25	5.00	4.25	4.25	4.00	3.25	6.25	4.75	4.25	5.25	4.50	3.75	6.5	5.5
47	7.25	3.25	4.50	4.75	2.00	3.75	6.75	3.50	4.25	5.50	3.00	3.75	4.5	4.5
48	7.50	3.00	3.75	5.00	3.75	2.75	7.00	3.00	3.50	5.25	2.50	3.25	10.5	9.5
51	7.00	2.75	3.75	5.25	2.00	3.25	6.75	2.50	3.75	5.75	2.00	3.25	5.5	4.5
54	9.25	4.00	3.25	5.00	3.25	2.50	8.25	4.00	3.50	6.50	3.50	3.25	5.0	5.0
55	7.25	4.00	5.50	6.75	2.75	3.00	7.50	4.00	5.25	6.75	3.50	5.00	4.0	3.5
56	6.00	2.00	4.50	4.00	2.75	2.25	4.50	1.50	4.00	3.75	1.25	3.50	9.0	5.5
58	6.00	3.75	4.50	6.25	3.00	4.00	5.50	3.25	4.50	5.00	3.00	4.00	6.0	5.0
62	7.50	2.00	3.50	5.50	1.00	2.50	6.00	2.00	3.25	5.00	1.50	2.25	8.0	7.0
Average	6.46	3.30	4.17	5.22	2.58	3.00	5.70	3.12	3.96	4.74	2.70	3.32	5.9	4.8

B = Before treatment.
A = After treatment.
AR = After retention.

whereas the decrease in the incisal overbite was 2.48 mm. The difference of 2.77 mm. represents the additional amount of depression of the upper and lower incisors. This intrusion was necessary not only to correct the original overbite condition but also to compensate for the increased overbite that was created by uprighting the protrusive maxillary and mandibular incisors. When the vertical distance between the upper and lower incisor root apices is measured in all the cases after retention, a decrease of 1.1 mm. in the interapical distance is discovered. The final interapical measurement is now 4.2 mm. This reduction in the interapical dimension demonstrated a greater distance and indicated that an improved overbite relationship existed after retention as compared with the overbite that was present when treatment began. These measurements were all oriented to the palatal plane.

A differential analysis by classification of twenty-nine Class I (Group Average II) and thirty-four Class II malocclusions (Group Average III) points to

almost identical behavior patterns. Similar changes, such as decrease in the overbite during treatment and settling after retention, were consistently noted throughout the study. Two notable exceptions between the Class I and Class II cases were the depth of the original overbite and the noticeable changes in the apex-to-apex measurement. The average original overbite in the Class II cases was approximately 1 mm. greater than the average original overbite in the Class I category.

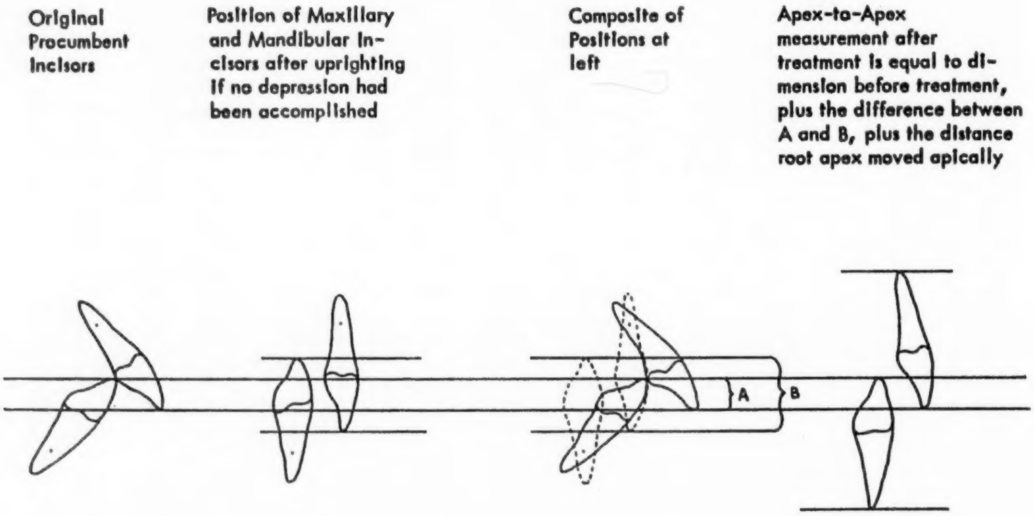


Fig. 4.—Variations in the measured overbite as recorded by the vertical distance between the apices of the maxillary and mandibular incisors. An analysis of the changes in the anterior overbite becomes more meaningful when the vertical distance between the root apices is considered. Unless the incisors are depressed in their alveoli in the process of reducing the procumbent incisors, the existing overbite will be largely increased. This anterior intrusion is accompanied by uprighting and extrusion of the buccal segments.

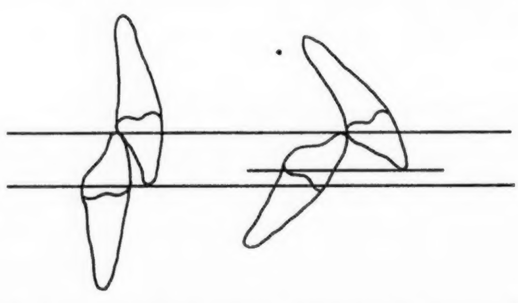


Fig. 5.—Variations in the measured overbite attributed to change in the angular relationships between maxillary and mandibular incisors. Regardless of any method that is used to record the measured overbite, it is axiomatic that the measurement is directly proportional to the angle between the maxillary and mandibular incisors. The greater the angle, the larger the measured overbite and vice versa. Also, the more upright the incisors, the less likelihood of differences in measurement due to the method used.

The most significant differences are noted in the interapical measurements of Class II cases after treatment, at which time this group demonstrated greater depression of the maxillary and mandibular incisors (1.5 mm. greater than Class I cases).

SUMMARY II. A SUMMARY OF TWENTY-NINE CLASS I CASES FROM TABLE II SHOWING CHANGES IN THE INCISAL OVERBITE BEFORE AND AFTER TREATMENT AND FOLLOWING RETENTION

	CASES OF OVERBITE LESS	CASES OF OVERBITE MORE	CASES OF OVERBITE SAME
Palatal plane			
A compared with B	28	1	0
AR compared with B	23	6	0
AR compared with A	5	19	5
Casts			
A compared with B	27	1	1
AR compared with B	27	2	0
AR compared with A	13	15	1
Facial plane			
A compared with B	27	1	1
AR compared with B	24	5	0
AR compared with A	5	19	5
Occlusal plane			
A compared with B	27	1	1
AR compared with B	23	5	1
AR compared with A	7	18	4
Apex-to-apex			
A compared with B	29	0	0
AR compared with B	28	1	0
AR compared with A	4	20	5

B = Before treatment.
A = After treatment.
AR = After retention.

SUMMARY III. A SUMMARY OF THIRTY-FOUR CLASS II CASES FROM TABLE III SHOWING CHANGES IN THE INCISAL OVERBITE BEFORE AND AFTER TREATMENT AND FOLLOWING RETENTION

	CASES OF OVERBITE LESS	CASES OF OVERBITE MORE	CASES OF OVERBITE SAME
Palatal plane			
A compared with B	33	1	0
AR compared with B	31	2	1
AR compared with A	4	27	3
Casts			
A compared with B	33	1	0
AR compared with B	33	1	0
AR compared with A	13	20	1
Facial plane			
A compared with B	33	1	0
AR compared with B	32	2	0
AR compared with A	4	26	4
Occlusal plane			
A compared with B	31	2	1
AR compared with B	31	3	0
AR compared with A	4	26	4
Apex-to-apex			
A compared with B	33	0	1
AR compared with B	33	1	0
AR compared with A	1	28	5

B = Before treatment.
A = After treatment.
AR = After retention.

TABLE IVA. AN ANALYSIS OF TEN CASES MANIFESTING THE DEEPEST ORIGINAL OVERBITES IN THE STUDY

PALATAL PLANE				CASTS				FACIAL PLANE				OCCLUSAL PLANE				APEX-TO-APEX		
CASE NO.	B*	A	AR	CASE NO.	B*	A	AR	CASE NO.	B*	A	AR	CASE NO.	B*	A	AR	CASE NO.	A	AR
3	8.25	4.25	4.50	3	7.75	2.00	3.50	3	7.00	4.25	4.00	2	5.75	1.75	2.50	3	5.0	4.5
9	7.25	4.00	4.00	20	6.50	2.50	2.25	22	7.25	2.25	4.25	3	6.00	3.75	3.75	9	6.0	5.0
22	8.50	2.25	4.00	21	10.00	2.25	4.00	24	7.75	3.00	5.00	22	5.75	2.00	3.50	22	10.5	9.0
24	8.25	3.00	5.25	22	7.00	2.25	2.25	37	7.25	5.00	6.00	24	6.50	2.25	4.25	24	5.5	3.0
37	8.00	5.25	6.25	36	7.00	4.75	4.50	39	6.75	5.00	5.75	28	5.50	4.00	3.25	37	9.5	7.5
38	7.75	2.25	2.25	37	6.75	4.50	5.50	41	7.00	3.25	3.25	36	5.75	5.75	4.25	38	8.0	8.0
41	7.50	3.50	4.00	40	6.75	3.50	4.75	47	6.75	3.50	4.25	37	6.25	4.25	4.50	41	2.5	2.5
48	7.50	3.00	3.75	43	7.50	5.00	4.50	48	7.00	3.00	3.50	51	5.75	2.00	3.25	48	10.5	9.5
54	9.25	4.00	3.25	55	6.75	2.75	3.00	54	8.25	4.00	3.50	54	6.50	3.50	3.25	54	5.0	5.0
62	7.50	2.00	3.50	58	6.25	3.00	4.00	55	7.50	4.00	5.25	55	6.75	3.50	5.00	62	8.0	7.0
Average	7.98	3.35	4.08	Average	7.23	3.25	3.83	Average	7.25	3.73	4.48	Average	6.05	3.28	3.75	Average	7.1	6.1

*The deepest overbite measurement as recorded by the particular method of measuring or plane of orientation.

TABLE IVB. AN ANALYSIS OF TEN CASES MANIFESTING THE LEAST ORIGINAL OVERBITES IN THE STUDY
*FIVE DIFFERENT METHODS OF MEASUREMENTS WERE USED—BEFORE TREATMENT, AFTER TREATMENT, AND FOLLOWING RETENTION

PALATAL PLANE				CASTS				FACIAL PLANE				OCCLUSAL PLANE				APEX-TO-APEX		
CASE NO.	B*	A	AR	CASE NO.	B*	A	AR	CASE NO.	B*	A	AR	CASE NO.	B*	A	AR	CASE NO.	A	AR
6	3.25	2.75	4.00	6	3.50	2.00	2.75	1	4.00	3.25	3.75	6	2.25	2.00	3.50	6	5.0	3.0
11	3.00	2.50	3.25	7	3.50	1.25	2.50	6	3.25	2.75	4.25	11	2.50	2.00	2.50	11	3.0	2.0
12	3.50	2.00	4.00	11	2.25	2.00	3.50	11	3.00	2.50	2.75	12	2.25	1.25	3.00	12	4.0	-1.0
13	2.50	1.25	4.00	13	2.75	2.50	2.50	12	3.00	1.50	3.50	13	2.00	0.75	3.00	13	3.5	1.0
15	3.50	2.00	2.50	17	3.75	3.00	2.50	13	2.25	1.25	3.50	15	2.50	1.00	1.75	15	6.0	5.0
17	4.00	3.00	3.25	27	3.25	1.25	2.25	15	3.25	1.75	2.50	19	2.50	2.00	2.00	17	3.5	3.5
19	3.00	2.25	3.00	29	3.50	3.00	3.25	19	2.75	2.00	2.00	27	3.00	1.75	2.50	19	0.0	-2.0
33	3.50	3.25	3.00	33	3.25	3.00	2.25	33	3.00	3.00	2.50	33	2.75	2.75	2.50	33	1.0	1.0
34	3.50	3.75	5.25	34	1.25	2.25	3.00	34	3.00	3.75	5.00	34	2.00	3.25	4.00	34	3.5	3.0
57	3.50	4.00	5.00	57	2.50	3.00	3.50	57	2.75	3.50	4.25	57	2.00	3.00	4.00	57	4.5	3.0
Average	3.32	2.67	3.72	Average	2.95	2.33	2.80	Average	3.03	2.53	3.40	Average	**2.38**	**1.98**	**2.88**	Average	3.4	1.9

*The least overbite measurement as recorded by the particular method of measurement or plane of orientation.
B = Before treatment.
A = After treatment.
AR = After retention.

Since Class II cases manifest greater labial axial inclination of maxillary incisors, it is understandable that reduction of these teeth must be accompanied by greater depression in order to lessen the increased anterior overbite (Figs. 4 and 5). While it is clear that the apices show greater distances in corrected Class II cases, their mode of settling after retention varies very little (about 1 mm.), regardless of the class of malocclusion.

Summaries II and III show changes in incisal overbite to be slightly better in Class II cases.

GROUP AVERAGE IV. AVERAGE CALCULATIONS REPRESENTING TYPICAL CHANGES IN THE INCISAL OVERBITE OF TEN CASES MANIFESTING THE DEEPEST ORIGINAL OVERBITES BEFORE TREATMENT, AFTER TREATMENT, AND AFTER RETENTION

PLANE OF ORIENTATION	BEFORE TREATMENT	AFTER TREATMENT	AFTER RETENTION
Palatal plane	7.98	3.35	4.08
Casts	7.23	3.25	3.83
Facial plane	7.25	3.73	4.48
Occlusal plane	6.05	3.28	3.75
Apex-to-apex		7.1	6.1

I next focused attention on the ten cases in this study that had the deepest original incisal overbites (Group Average IV) and compared them with the ten cases that had the smallest original incisal overbites (Group Average V). The objective was to ascertain the difference in the corrected overbite, after treatment and after retention, between those cases with the deepest original overbites and those with the smallest original overbites.

The average change in the ten patients with the greatest original overbites (7.98 mm.) was a reduction to 3.35 mm. after treatment. These cases were oriented to the palatal plane. Following a period of retention, the overbite increased slightly to an average of 4.08 mm. The important factor in the appraisal of the ten deepest overbites was that all patients had an improved overbite after treatment and, most important, a smaller measured incisal overbite after retention than at the beginning of treatment. The results were similar with all the methods of orientation (Table VI).

GROUP AVERAGE V. AVERAGE CALCULATIONS REPRESENTING TYPICAL CHANGES IN THE INCISAL OVERBITE OF TEN CASES MANIFESTING THE LEAST ORIGINAL OVERBITE BEFORE TREATMENT, AFTER TREATMENT, AND AFTER RETENTION

PLANE OF ORIENTATION	BEFORE TREATMENT	AFTER TREATMENT	AFTER RETENTION
Palatal plane	3.32	2.67	3.72
Casts	2.95	2.33	2.80
Facial plane	3.03	2.53	3.40
Occlusal plane	2.38	1.98	2.88
Apex-to-apex		3.4	1.9

In a further evaluation of Group Average IV (ten deepest overbites), the interapical measurements after treatment showed an increase of 7.1 mm. compared to an incisal overbite decrease of 4.63 mm. This actually represents a decrease in the overbite relationship. An example of change after retention is demonstrated by the vertical decrease in the incisor interapical dimension. There

the distance is 1 mm. less than after treatment. The average apex-to-apex distance after retention was 6.1 mm., while the incisal overbite showed a 0.73 mm. increase to 4.08 mm.

There followed an attempt to ascertain the degree of overbite correction and the character of stability in those patients who had the least original overbites (Group Average V). Ten cases were selected for study, and the x-ray records were oriented to the palatal plane. The average original incisal overbite measured 3.32 mm. Following treatment the overbite was reduced 0.65 mm., making an average overbite of 2.67 mm. for all ten cases after treatment was completed. Following a period free of retention, there occurred an increase of 1.05 mm. in the overbite. The average overbite in the ten cases, then, measured 3.72 mm.

These results strongly call attention to the fact that there occurred a greater degree of overbite settling in those cases with the least overbite as compared to those with the greatest. The difference in the deep-overbite cases after retention, as compared to after treatment, was but 0.73 mm. (Group Average IV). Orientation of the overbite measurements to either the facial or the occlusal plane shows similar decreased changes in overbite after treatment and an increase after retention.

An interesting fact that drew my attention was that six of the eight patients who had a greater overbite after retention than before treatment (Table VI and Summary I) were also among the group of ten patients in this appraisal who had the smallest original overbites. This situation was verified by using other methods of orientation and measurements, namely, the facial plane, the occlusal plane, and the dental casts. The information disclosed in this study clearly pointed to the fact that the overbite results were better in the ten cases with the deepest original overbites than in the group of a similar number with the least original overbites. These results brought to light facts that cannot easily be explained. It is possible that greater emphasis was placed on overbite correction in the deep-overbite cases during the various treatment procedures, thus yielding a better end result.

The interapical dimensions again seem to portray the behavior of the upper and lower anterior teeth more clearly than other means of measurement. Of utmost significance is the comparison of the difference in the after-treatment and pretreatment apex-to-apex distances. In the two groups of ten cases with the greatest and the least overbites, the differences in the interapical distance were very marked (Group Averages IV and V). The smaller-overbite cases showed a difference in distance of 3.4 mm. after treatment, while the deeper-overbite cases showed a difference of 7.1 mm. This large apex-to-apex increase would certainly represent strong efforts to depress the maxillary and mandibular incisors in the deeper-overbite cases. In this study almost all cases with greater overbites belong to the Class II category (Tables III and IV) and are also characterized by marked protrusions. The treatment plan, therefore, becomes obvious. Clinically, efforts are always directed toward depression of incisors while their procumbency is being reduced. If this depressive activity were not included in appliance therapy, the lingual movement of the protrusive maxillary and/or mandibular incisors would produce a deeper overbite.

Following retention and a period of adjustment, interapical distance closed an average of 1.5 mm. in the least-overbite cases, and a surprisingly smaller decrease (1 mm.) occurred in those cases with the largest original overbites. The ten cases with the least original overbites showed an interapical difference 1.9 mm. greater than before treatment began, whereas in those cases with the deepest original overbites the average final interapical dimension was 6.1 mm. greater than before treatment (Table IV).

TABLE VA. INDIVIDUAL MEASUREMENTS OF OVERBITES IN THE TEN CASES FREE FROM RETENTION FOR THE LONGEST PERIOD OF TIME

CASE NO.	YEARS AND MONTHS	PALATAL PLANE			CASTS			FACIAL PLANE			OCCLUSAL PLANE			APEX-TO-APEX	
		B	A	AR*	B	A	AR*	B	A	AR*	B	A	AR*	A	AR*
3	6.4	8.25	4.25	4.50	7.75	2.00	3.50	7.00	4.25	4.00	6.00	3.75	3.75	5.0	4.5
5	5.11	7.00	4.00	5.25	5.50	2.50	4.00	5.75	3.25	5.00	5.25	3.00	4.25	4.5	3.5
14	6.5	6.00	3.00	5.00	4.50	2.25	3.00	5.75	2.75	5.00	4.25	2.25	4.00	6.0	3.5
18	6.4	5.25	3.25	5.00	4.50	2.00	3.75	4.75	3.00	4.50	3.50	2.25	3.25	4.0	2.0
19	6.6	3.00	2.25	3.00	4.00	2.00	1.75	2.75	2.00	2.00	2.50	2.00	2.00	0.0	-2.0
24	5.11	8.25	3.00	5.25	6.00	4.00	4.25	7.75	3.00	5.00	6.50	2.25	4.25	5.5	3.0
35	6.1	5.00	2.25	4.50	4.00	2.00	3.75	4.75	2.00	4.25	4.25	1.75	3.25	5.5	1.5
36	7.5	7.00	6.75	5.00	7.00	4.75	4.50	6.50	6.25	4.50	5.75	5.75	4.25	2.5	4.5
46	6.8	5.25	4.00	5.50	4.00	2.25	3.50	4.50	3.75	5.00	3.75	3.00	4.25	5.0	2.0
62	7.5	7.50	2.00	3.50	5.50	1.00	2.50	6.00	2.00	3.25	5.00	1.50	2.25	8.0	7.0
Average	6.6	6.25	3.48	4.65	5.28	2.48	3.45	5.55	3.23	4.25	4.68	2.75	3.55	4.6	3.0

*Longest period of time: 6 years 6 months (average).

TABLE VB. INDIVIDUAL MEASUREMENTS OF OVERBITES IN THE TEN CASES FREE FROM RETENTION FOR THE SHORTEST PERIOD OF TIME

CASE NO.	YEARS AND MONTHS	PALATAL PLANE			CASTS			FACIAL PLANE			OCCLUSAL PLANE			APEX-TO-APEX	
		B	A	AR*	B	A	AR*	B	A	AR*	B	A	AR*	A	AR*
1	1.5	5.00	3.00	4.00	5.00	3.25	3.00	4.00	3.25	3.75	3.25	3.00	3.00	7.0	6.5
8	1.8	7.00	3.75	3.50	4.25	3.25	2.25	5.25	3.00	3.00	4.50	3.00	2.25	7.0	6.0
10	1.11	6.25	4.00	5.00	5.25	2.50	3.75	6.25	3.25	4.75	5.00	3.00	3.75	4.5	3.0
11	1.7	3.00	2.50	3.25	2.25	2.00	3.50	3.00	2.50	2.75	2.50	2.00	2.50	3.0	2.0
16	1.10	5.00	3.75	3.75	4.50	2.25	3.75	4.25	3.50	3.50	3.75	3.00	3.00	1.0	1.0
22	1.8	8.50	2.25	4.00	7.00	2.25	2.25	7.25	2.25	4.25	5.75	2.00	3.50	10.5	9.0
25	1.11	5.75	3.00	2.25	5.00	3.00	2.00	4.75	2.75	1.75	4.25	2.00	1.00	5.0	5.5
30	2.1	5.25	4.25	3.75	4.25	3.25	1.75	4.50	4.00	3.25	3.50	3.25	3.00	4.5	3.5
40	1.11	6.25	4.25	5.00	6.75	3.50	4.75	6.00	4.25	5.00	4.25	3.50	3.75	2.5	1.5
45	1.8	5.50	2.00	2.50	4.25	3.00	2.50	5.25	1.75	2.25	4.50	1.25	1.50	7.0	6.5
Average	1.9	5.75	3.28	3.70	4.85	2.83	2.95	5.05	3.05	3.43	4.53	2.60	2.73	5.2	4.5

*Shortest period of time: 1 year 9 months (average).
B = Before treatment.
A = After treatment.
AR = After retention.

Time Study—Out of Retention.—The influence of time on the manner of overbite adjustment was now studied. The ten patients from the entire group who were out of retention for the longest period of time were compared with the ten patients out of retention for the shortest interval (Table V). The range for the ten patients out of retention for the longest period was seven years five months to five years eleven months. The average in this group was six years six months. The average time was one year nine months for the ten patients with the shortest retention period. A study of the incisal overbite of the cases

TABLE VI. INDIVIDUAL MEASUREMENTS REPRESENTING CHANGES WHERE THE INCISAL OVERBITE WAS GREATER EITHER AFTER TREATMENT OR FOLLOWING RETENTION AS COMPARED TO THE ORIGINAL

PALATAL PLANE				CASTS				FACIAL PLANE				OCCLUSAL PLANE				APEX-TO-APEX		
CASE NO.	B	A	AR	CASE NO.	B	A	AR	CASE NO.	B	A	AR	CASE NO.	B	A	AR	CASE NO.	A	AR
6	3.25	2.75	4.00	11	2.25	2.00	3.50	6	3.25	2.75	4.25	6	2.25	2.00	3.50	12	4.0	-1.0
11	3.00	2.50	3.25	34	1.25	2.25	3.00	12	3.00	1.50	3.50	12	2.25	1.25	3.00	19	0.0	-2.0
12	3.50	2.00	4.00	57	2.50	3.00	3.50	13	2.25	1.25	3.50	13	2.00	0.75	3.00			
13	2.50	1.25	4.00					34	3.00	3.75	5.00	34	2.00	3.25	4.00			
34	3.50	3.75	5.25					46	4.50	3.75	6.00	42	3.75	4.00	4.50			
46	5.25	4.00	5.50					53	4.50	4.25	5.25	46	3.75	3.00	4.25			
53	4.50	4.25	5.00					57	2.75	3.50	4.25	53	4.25	3.50	4.75			
57	3.50	4.00	5.00									57	2.00	3.00	4.00			

B = Before treatment.
A = After treatment.
AR = After retention.

with the longest free retentive period showed an average settling 0.75 mm. greater than those cases in the shortest free retentive period (Group Averages VI and VII). The degree of adjustment, revealed from the apex-to-apex dimensions, showed that the average settling was 0.9 mm. more in the interapical distance of the ten patients free from retention for the longest period of time.

GROUP AVERAGE VI. AVERAGE CALCULATIONS REPRESENTING TYPICAL CHANGES IN THE INCISAL OVERBITE IN THE TEN CASES FREE FROM RETENTION FOR THE LONGEST PERIOD OF TIME

PLANE ORIENTATION	BEFORE TREATMENT	AFTER TREATMENT	AFTER RETENTION
Palatal plane	6.25	3.48	4.65
Casts	5.28	2.48	3.45
Facial plane	5.55	3.23	4.25
Occlusal plane	4.68	2.75	3.55
Apex-to-apex		4.6	3.0

GROUP AVERAGE VII. AVERAGE CALCULATIONS REPRESENTING TYPICAL CHANGES IN THE INCISAL OVERBITE IN THE TEN CASES FREE FROM RETENTION FOR THE SHORTEST PERIOD OF TIME

PLANE ORIENTATION	BEFORE TREATMENT	AFTER TREATMENT	AFTER RETENTION
Palatal plane	5.75	3.28	3.70
Casts	4.85	2.83	2.95
Facial plane	5.05	3.05	3.43
Occlusal plane	4.53	2.60	2.73
Apex-to-apex		5.2	4.5

DISCUSSION AND SUMMARY

This investigation has been concerned principally with the effect of extraction treatment on the incisal overbite. Sixty-three cases representing the typical malocclusions were used. (Photographs of the sixty-three cases appear on pages 774 to 784.)

1. Lateral cephalometric roentgenograms were applied in each case, together with dental casts, in order to obtain a more comprehensive picture of the overbite changes.

2. Different planes of orientation were used in conjunction with the cephalometric x-rays. These were the palatal plane, the facial plane, and the occlusal plane. Measurements derived from these sources were compared with measurements derived from the overbite found on dental casts.

3. X-ray pictures, photographs, and dental casts were taken before treatment, after treatment, and subsequent to the removal of all retaining devices.

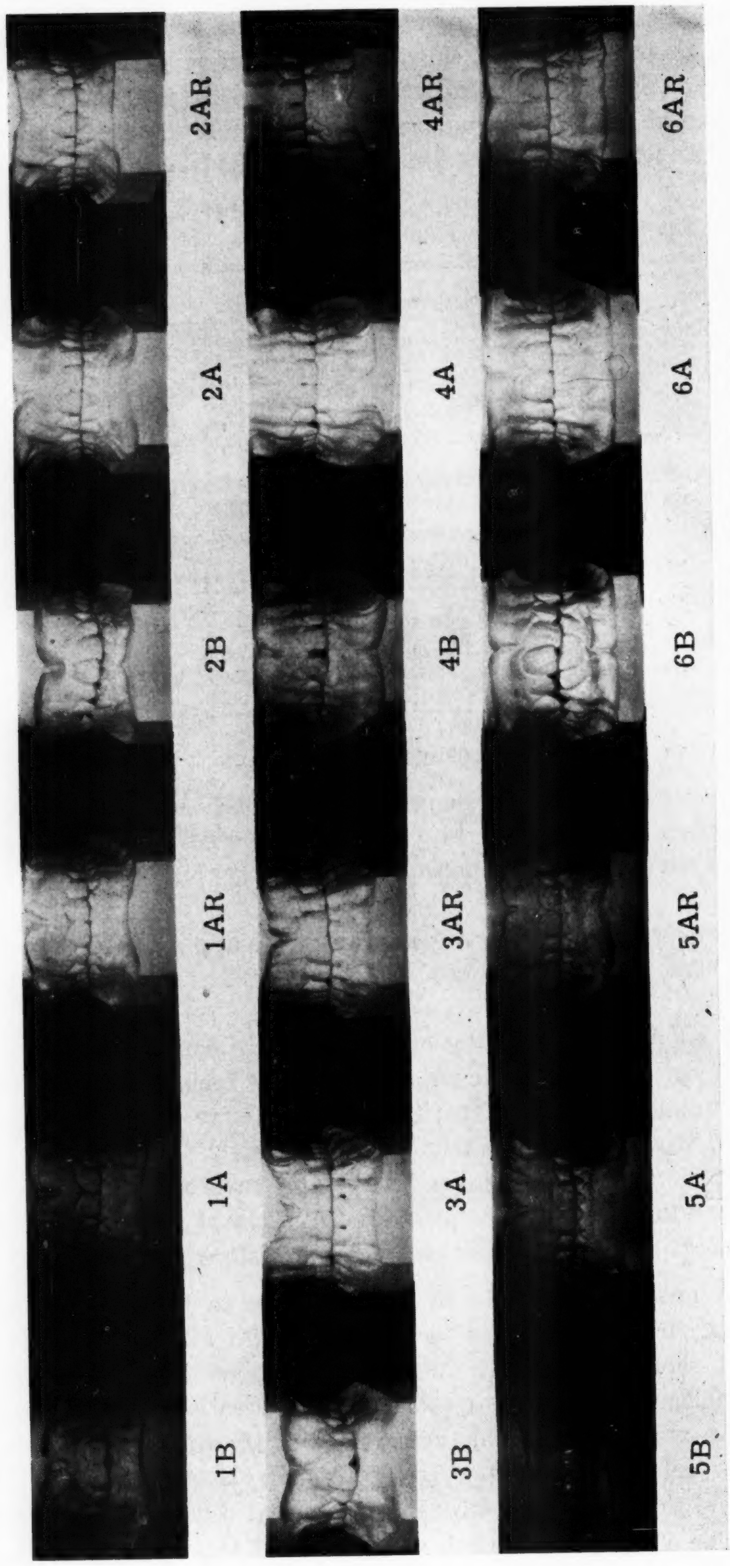
4. Examination of the material included the following:

(a) A gross study of the overbite changes in the group of sixty-three patients before and after treatment and after retention.

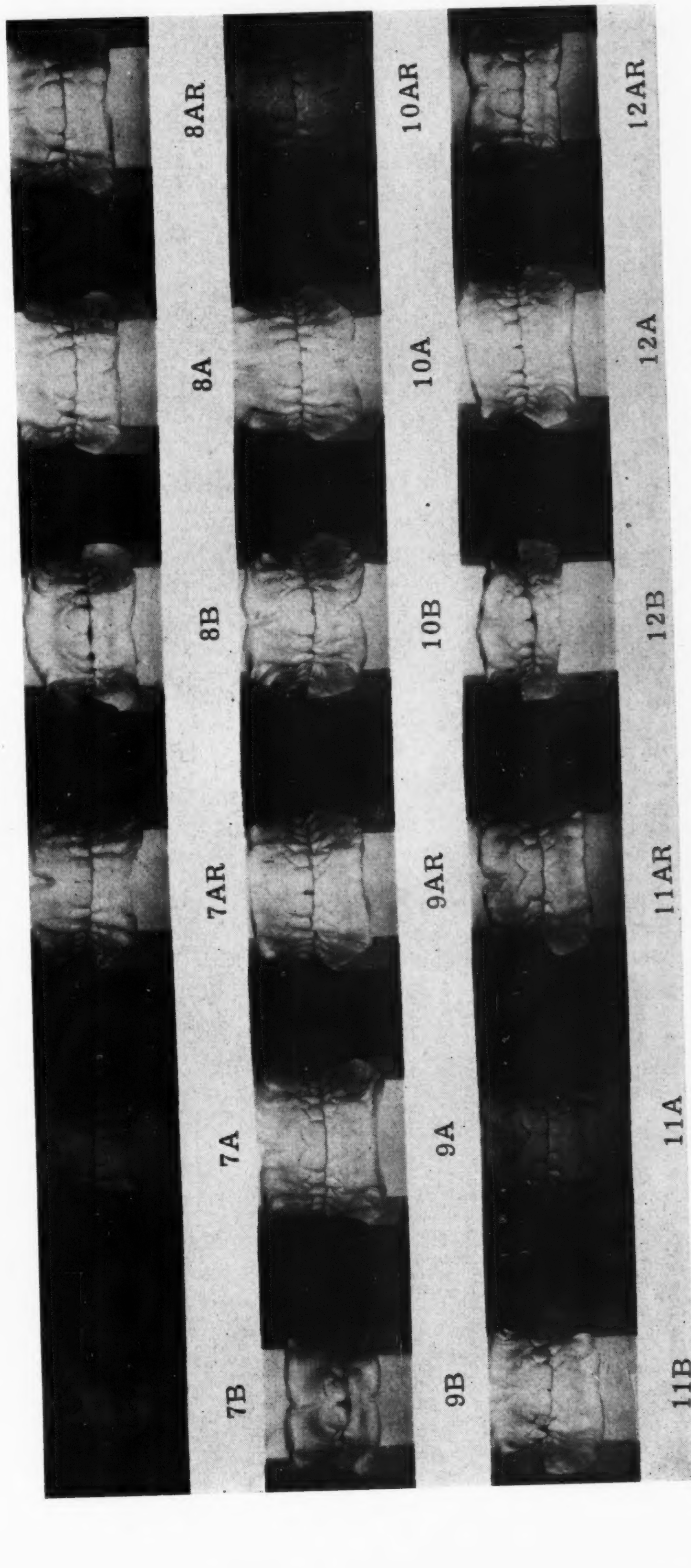
(b) A separate study of the overbite changes in Class I and Class II malocclusions before treatment, after treatment, and after retention.

(c) An analysis based on the severity of the overbite before treatment, as related to the degree of overbite obtainable after treatment, and the amount of natural settling that occurred after retention.

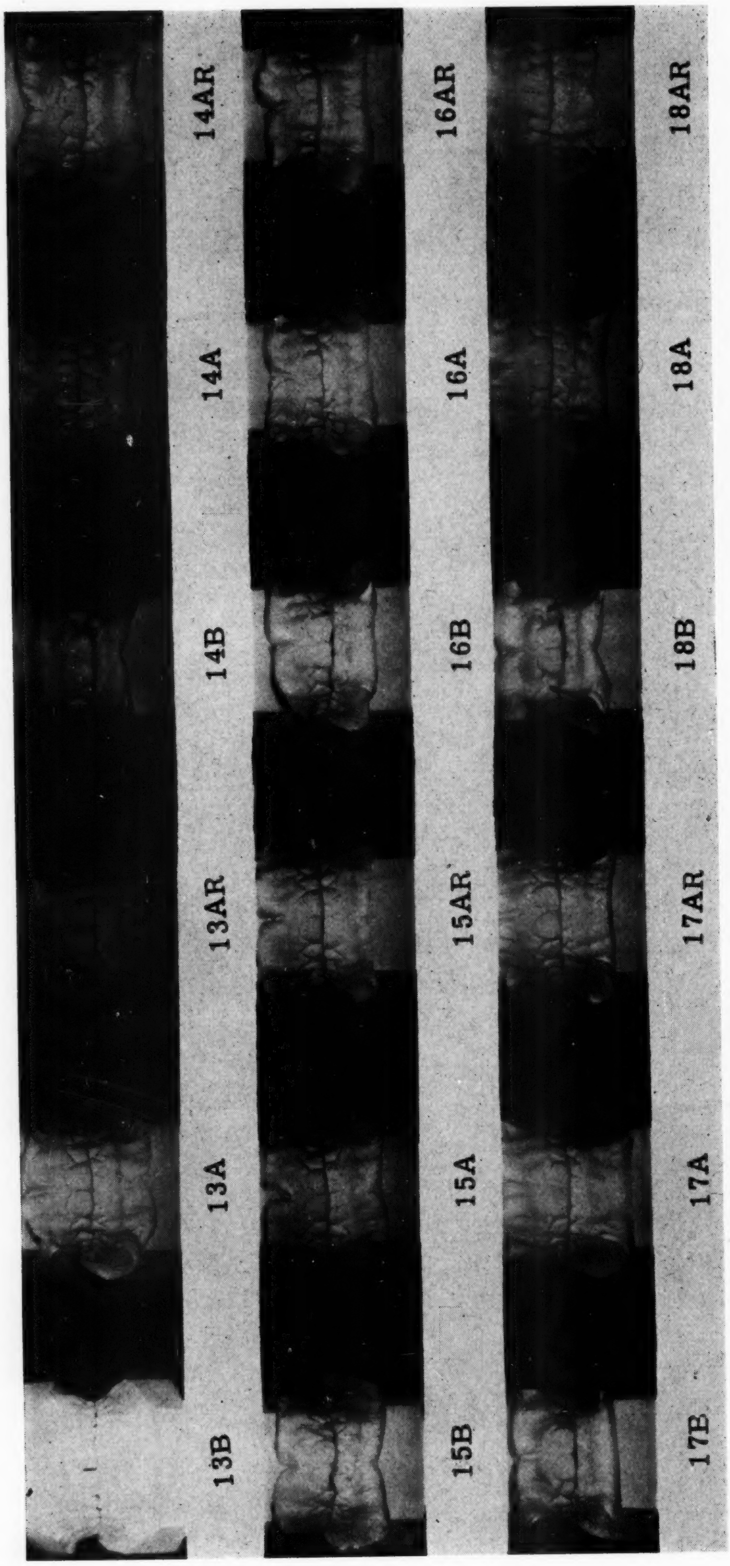
(d) The effect of the length of time out of retention on the stability of the corrected overbite.



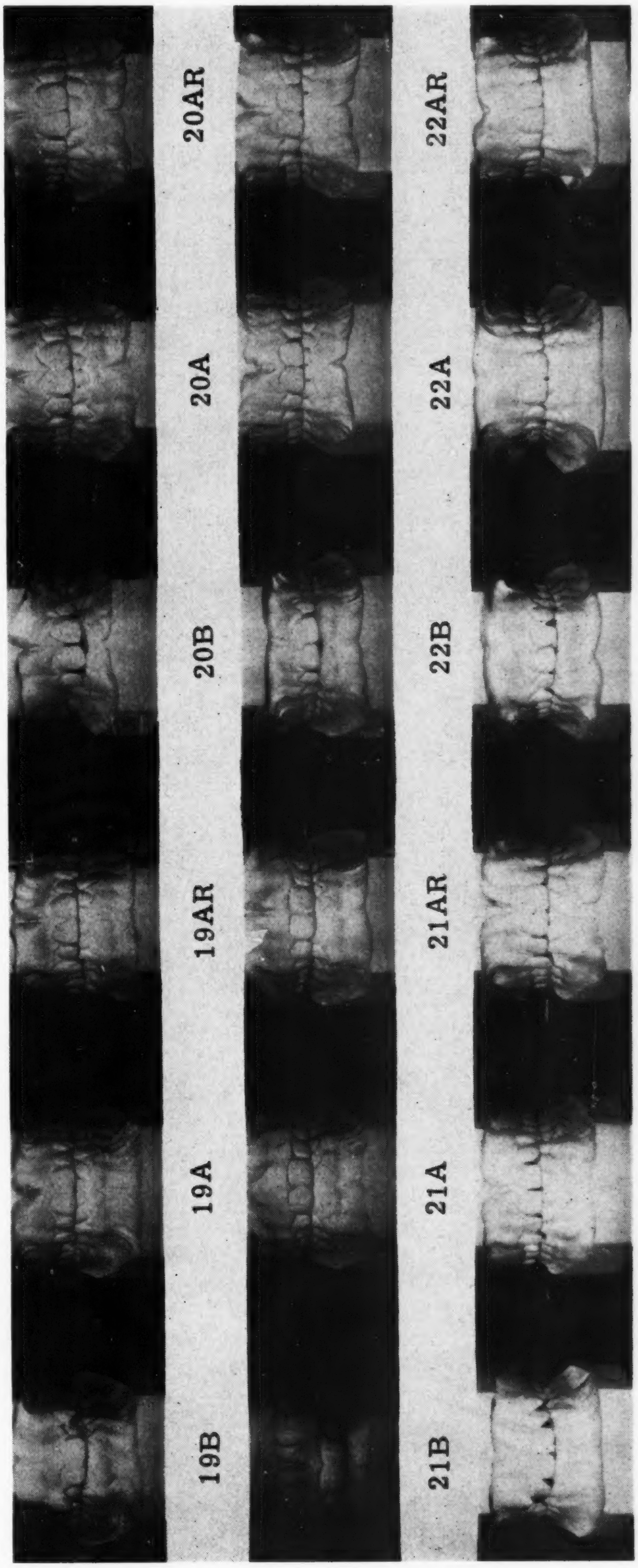
Cases 1 to 6 before treatment *(B)*, after treatment *(A)*, and after retention *(AR)*.



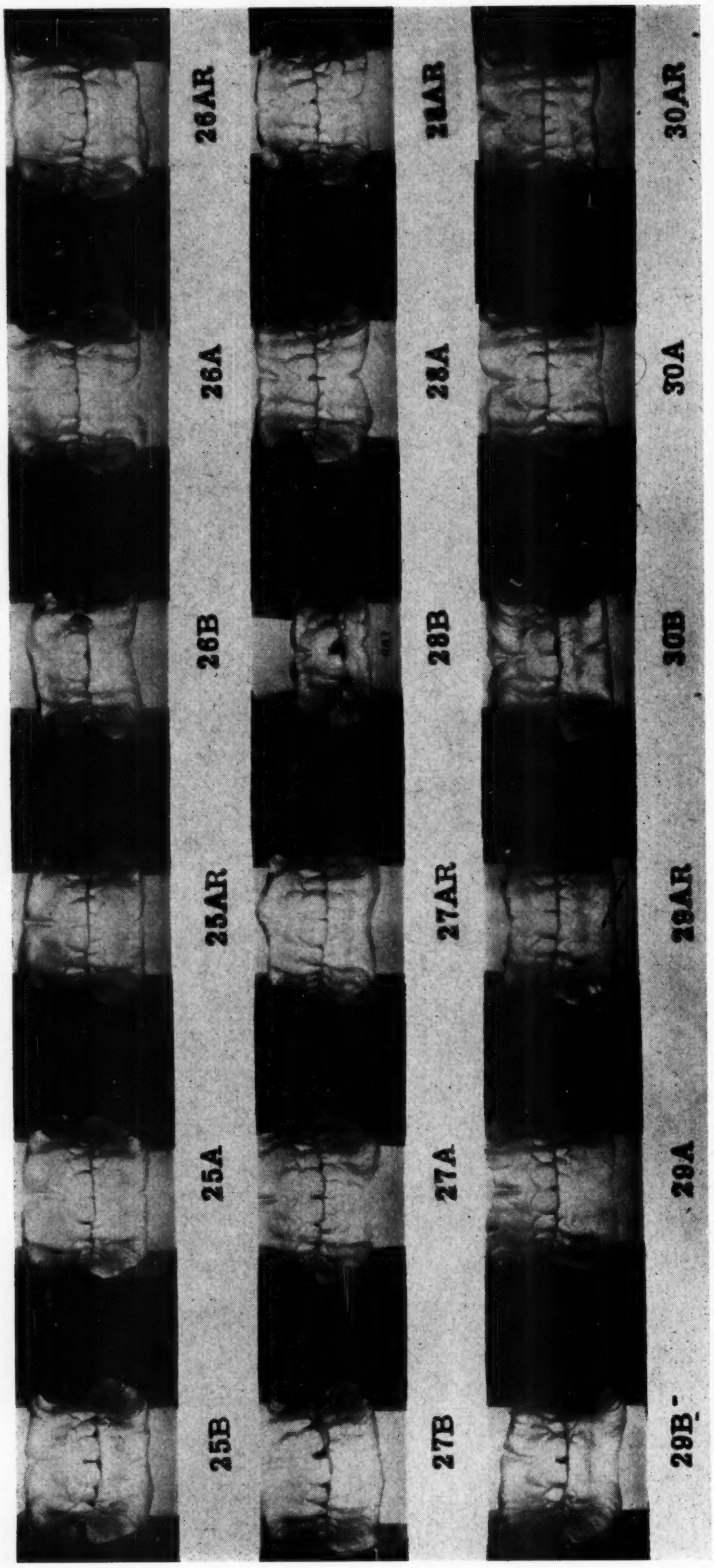
Cases 7 to 12 before treatment (*B*), after treatment (*A*), and after retention (*AR*).



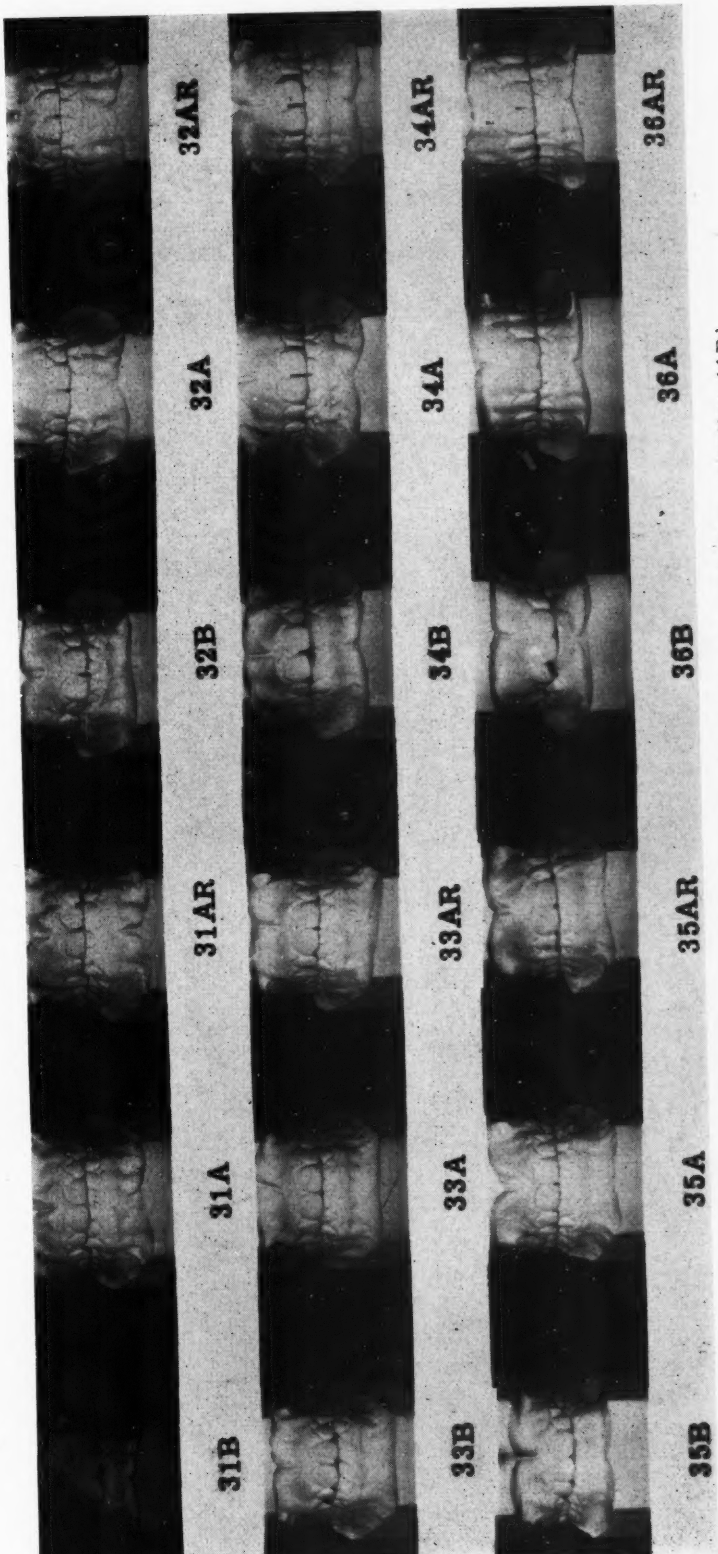
Cases 13 to 18 before treatment *(B)*, after treatment *(A)*, and after retention *(AR)*.



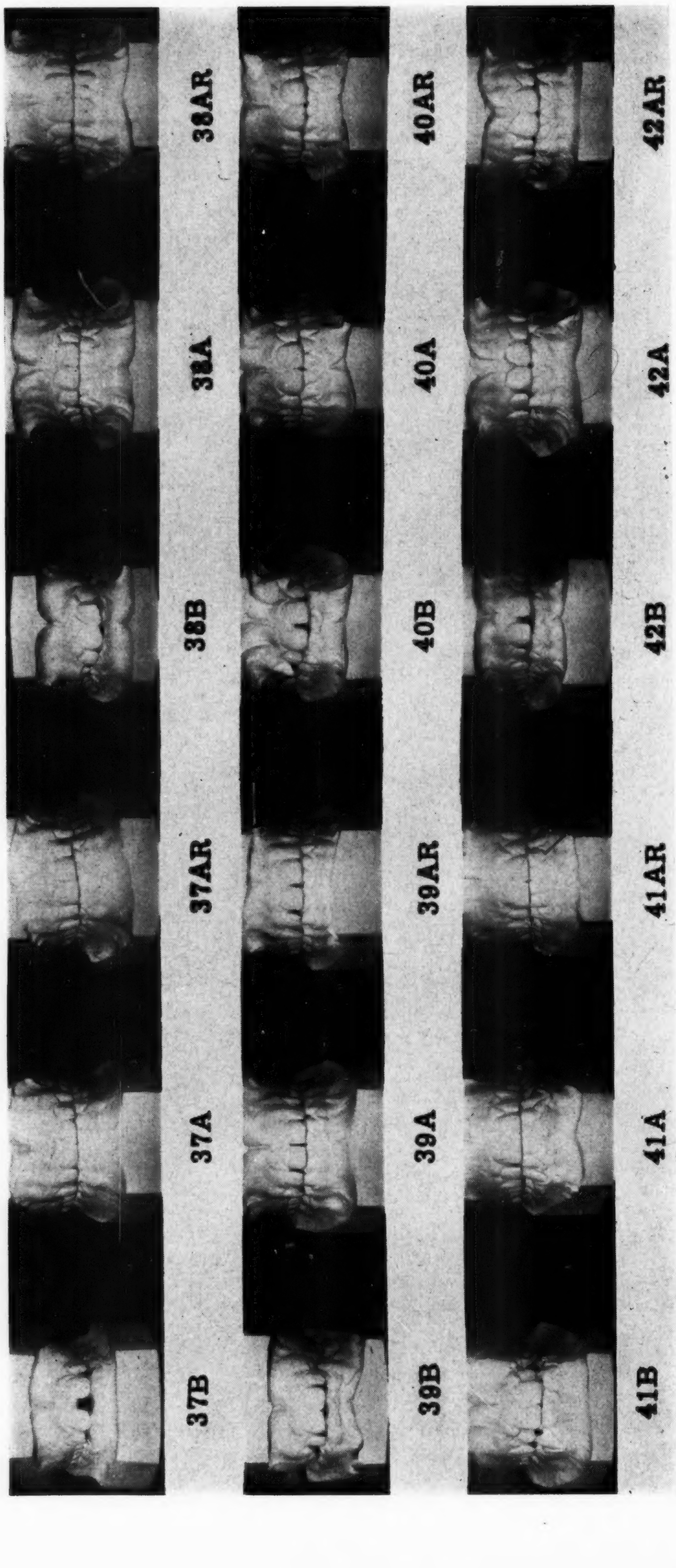
Cases 19 to 24 before treatment *(B)*, after treatment *(A)*, and after retention *(AR)*.



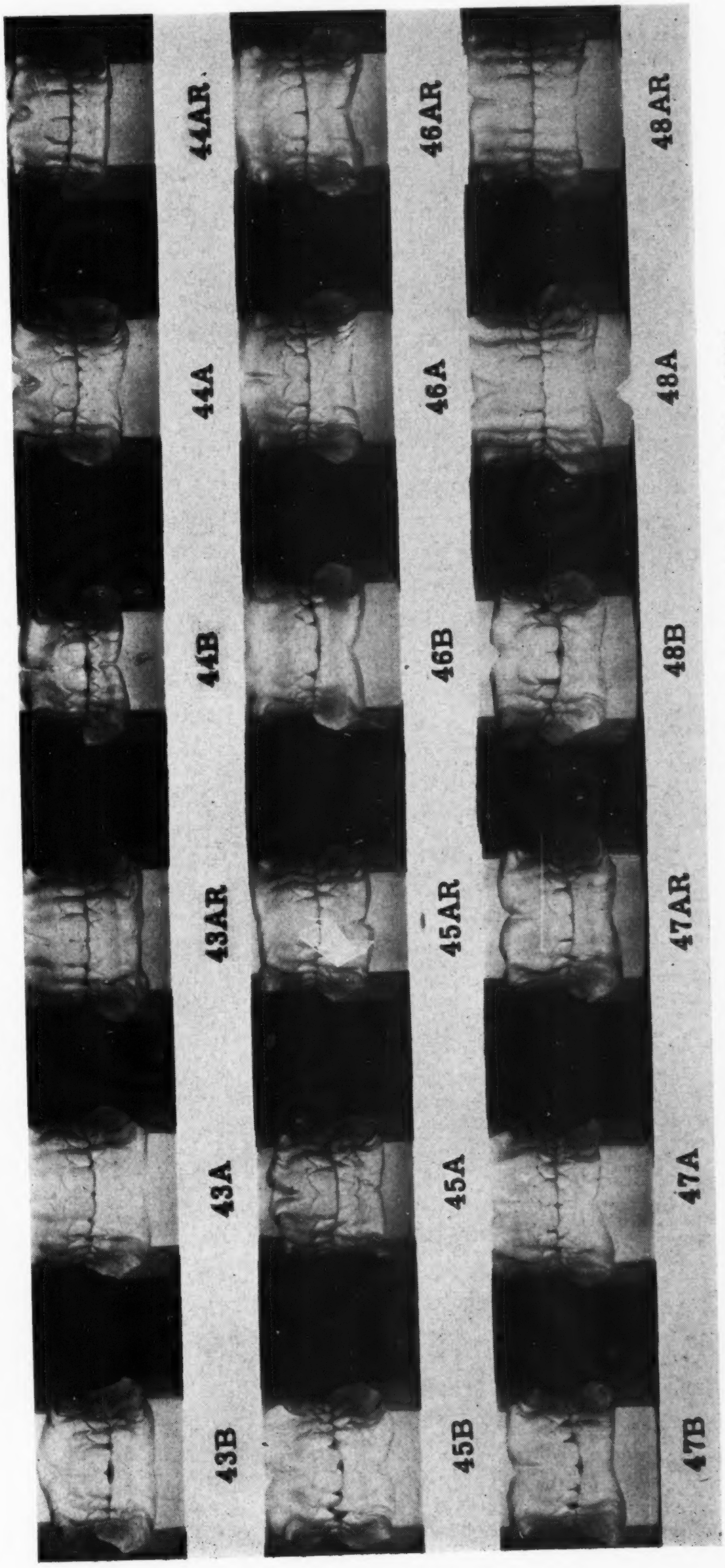
Cases 25 to 30 before treatment *(B)*, after treatment *(A)*, and after retention *(AR)*.



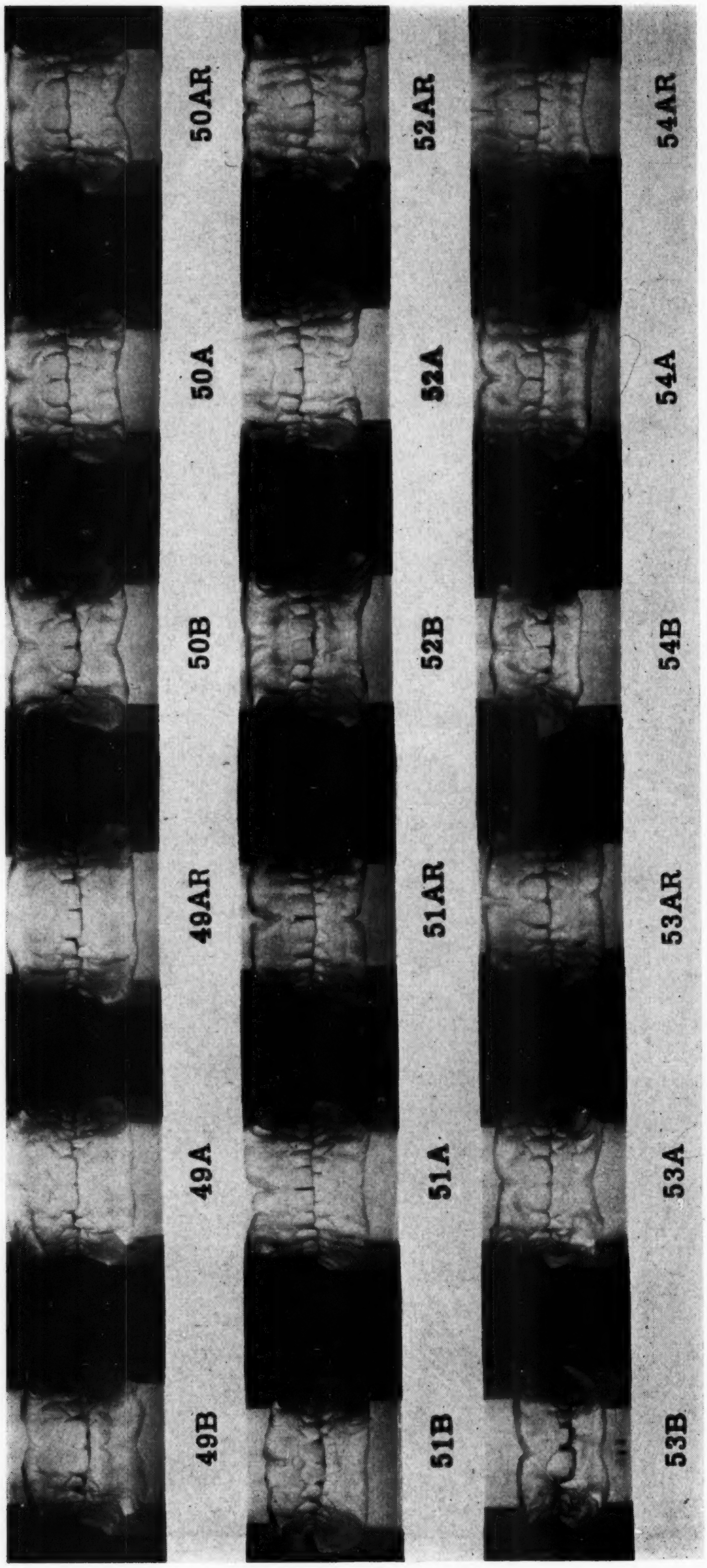
Cases 31 to 36 before treatment *(B)*, after treatment *(A)*, and after retention *(AR)*.



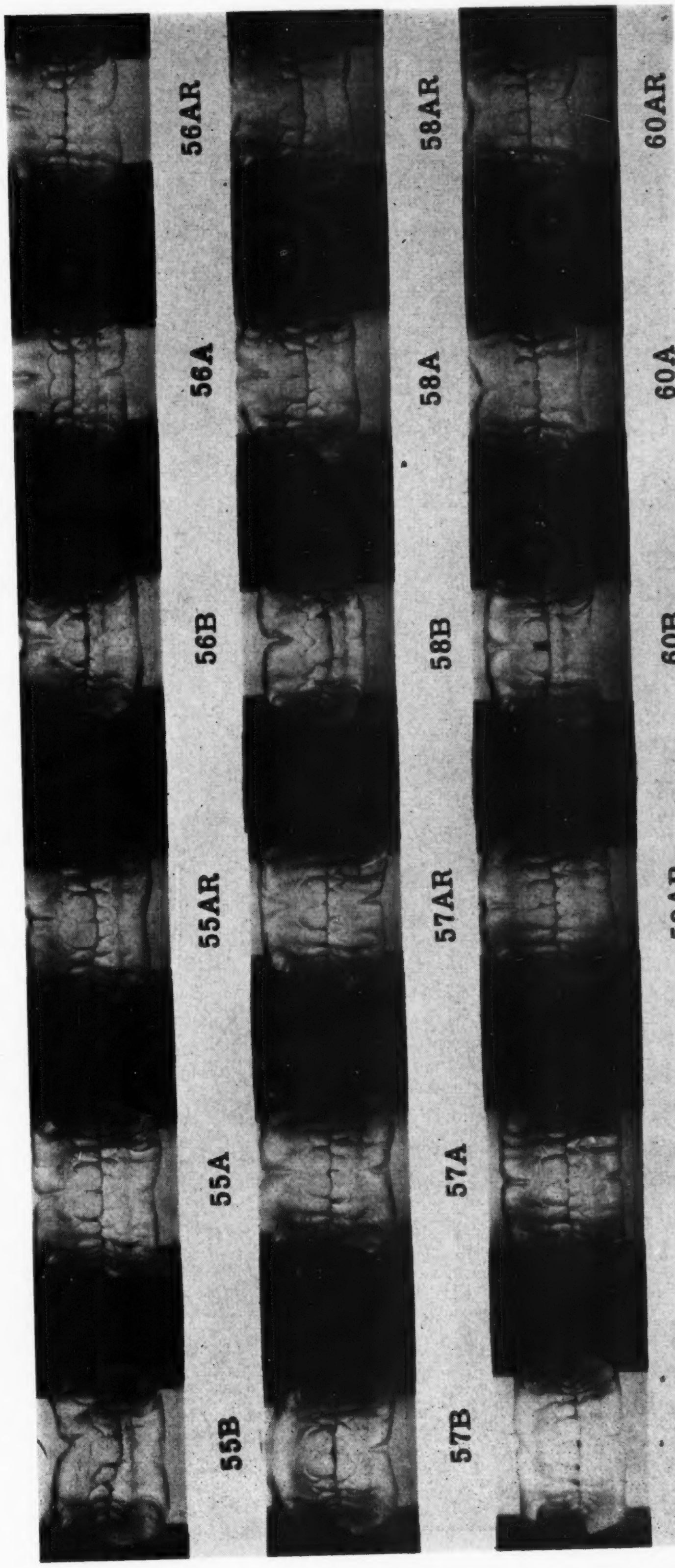
Cases 37 to 42 before treatment (*B*), after treatment (*A*), and after retention (*AR*).



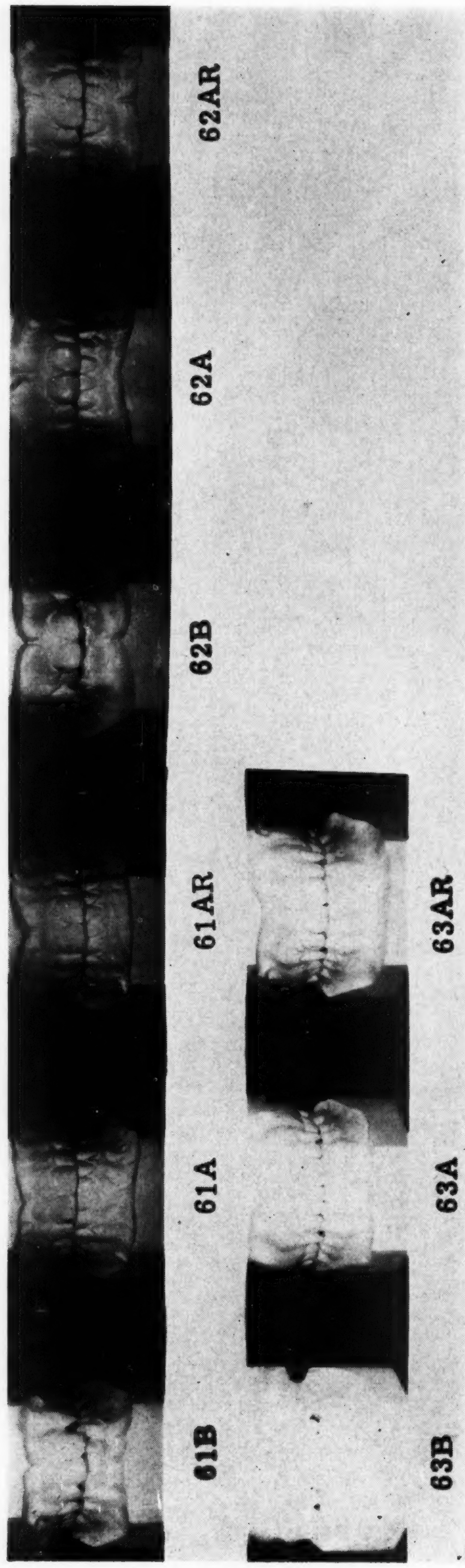
Cases 43 to 48 before treatment *(B)*, after treatment *(A)*, and after retention *(AR)*.



Cases 49 to 54 before treatment *(B)*, after treatment *(A)*, and after retention *(AR)*.



Cases 55 to 60 before treatment (*B*), after treatment (*A*), and after retention (*AR*).



Cases 61 to 63 before treatment *(B)*, after treatment *(A)*, and after retention *(AR)*.

5. The ages of the sixty-three patients ranged from 10 to 13 years. There were forty girls and twenty-three boys.

6. A technique is discussed whereby the interapical distance of the maxillary and mandibular incisors can be measured. The relationship between the degree of procumbency of the upper and lower incisors and the measured incisal overbite is discussed. The significance of the plane of orientation and its bearing on the measured overbite are explained.

7. Emerging as a dominant factor is the disclosure that all but two cases had less overbite after treatment than before the correction began. While it is clearly demonstrated that most of the overbites increased slightly after retention, 85 per cent of the total cases studied still had less overbite than when treatment began.

8. A comparative appraisal of Class I and Class II cases revealed similar changes in overbite behavior. Although the Class II cases demonstrated a larger original overbite, the measurements revealed that the incisors in the Class II cases were depressed to a greater degree during treatment. This depression appeared to be absolutely necessary in order to compensate for the extensive lingual movement needed to correct malocclusions in this class. The best results attained with the least degree of settling were achieved in those patients with the most severe original overbites. Almost all of these had Class II malocclusions.

9. The few patients who manifested deeper overbites after treatment and after retention than appeared originally had the smallest measured overbites before treatment began.

10. Every patient with an original deep overbite, without exception, showed less overbite after treatment and after retention than when treatment began.

11. Although there were slight variations in calculations, depending upon the method of measurement or the plane of orientation, the results proved to be approximately the same.

12. The overbite dimensions derived from the dental casts exhibited the most favorable results. Of the cases measured in this manner, 95 per cent showed a smaller overbite after retention than at the beginning of treatment.

13. Since depression of the maxillary and mandibular incisors is a cardinal part of my treatment plan, I felt that measurements of the incisal overbite alone would be inadequate to portray the complete activities of these teeth in a study of overbite changes. It was therefore necessary to ascertain the changes in vertical distance between the apices of the upper and lower incisors.

14. The average degree of overbite settling after retention for the entire group studied was approximately 1 mm., irrespective of the method of measurement. On the other hand, an examination of the patients who had been out of retention for the longest period of time (an average of six years six months) showed a settling of 1.5 mm. Nevertheless, the average overbite measurement still showed less incisal overbite than when treatment began.

CONCLUSIONS

1. Tooth extraction should not cause an increase in the overbite if adequate therapy is employed. Deep overbite, per se, before treatment is not necessarily a contraindication to extraction therapy.

2. The overbite correction appears to be directly controlled in a large measure by the type and quality of therapy administered.

3. Class II, Division 1 deep overbite cases did not present any contraindication to extraction therapy, since without exception treatment terminated with uniformly decreased overbites after treatment and after retention.

4. The various methods of measurement show the same results regardless of the plane of orientation.

5. The interapical distance and the general movement of the apices should be considered for a more complete analysis of the overbite changes.

6. One-half the amount of overbite settling takes place within two years or less after the discontinuance of all retaining devices.

7. It is suggested that a similar study be made on a large number of Class II, Division 2 cases inasmuch as they represent a specialized type of deep overbite.

8. The original and final measurements, in millimeters, express the extent of the overbite and the degree of stability before and after the correction of a malocclusion. The individual measurements and tables are not meant to act as a standard relative to the degree of overbite.

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1901 WALNUT ST.

Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York.

Abstracts of Papers Presented Before the Research Section of the American Association of Orthodontists Washington, D. C., April 26, 1960

A Cephalometric Study of Facial Symmetry: By Irving L. Shore, University of Pittsburgh, Pittsburgh, Pa.

The varying degrees of asymmetry of the facial skeleton in man with both excellent and aberrant occlusions were measured on posteroanterior roentgenograms taken with the subjects positioned in a Margolis cephalostat.

The points of reference were on the Frankfort horizontal and midfacial planes, the latter being established for each individual subject according to his peculiar skeletal structure.

The bony landmarks checked in this study were the lateral extent of the cranium, the lateral extent and height of the zygomatic arches, and the lateral extent and height of the gonia. The middental lines of both the maxilla and the mandible were also examined. The method of construction of the midfacial plane suggests a possible means of checking radiographically the deviation(s) of the middental line on any person.

The points determining the midfacial plane are (1) the point at the bisection of the line between the mesial aspects of the orbits at the level of the planum sphenoid at each orbit and (2) the bisection of lines intersecting projections perpendicular to the Frankfort horizontal which are tangent to the lateral nasal walls, these projections being intersected by a line drawn tangent to the most inferior points of each nasal cavity along which the point is found.

A total of ninety-two subjects was used. There were twenty-two normal persons and seventy non-normal persons (occusally).

There was no significant correlation between occlusion (in the normal or non-normal groups) and symmetry or asymmetry. In all subjects it was found that some asymmetry existed independent of occlusal relationships, suggesting that no one presents complete symmetry.

324 W. ROOSEVELT BLVD.
PHILADELPHIA, PA.

A Study of Correlation of Denture and Skeletal Widths: By Edward Buchanan Warren, University of Tennessee, College of Dentistry; Holly Springs, Mississippi.

The purpose of the study was to establish normal variability of denture and skeletal widths in young adult and white males with good to excellent occlusions, and to ascertain whether any correlation exists between certain denture measurements and certain skeletal measurements.

The skeletal measurements were taken from lateral and frontal cephalometric roentgenograms corrected for distortion. Those used were: *Lo-Lo*, from orbitale on one side to lateral orbitale on the opposite side; *Mx-Mx*, from maxillare on one side to maxillare on the opposite side; *Mm-Mm*, minimum bimaxillary width dimension; *Go-Go*, from gonion on one side to gonion on the opposite side. Denture measurments used were taken from dental casts and included maxillary and mandibular bicanine width taken from the tips of the cusps, and maxillary and mandibular bimolar width taken from the center of the mesial marginal ridge of the first molar.

For each measurement the mean, standard deviation, standard error and range was established. Also correlations were made between the mandibular denture measurements and the bigonial skeletal measurement, also between the maxillary denture measurements and the various upper skeletal measurements. The "t" test was used for each of the correlations to ascertain their level of significance. The 95 per cent level was accepted as significant.

It was found that denture measurements show less variation than do skeletal measurements. Also mandibular denture measurements show less variation than do maxillary denture measurements. However, in the correlation study the mandibular denture measurements, though highly constant in themselves, do not correlate significantly with the bigonial measurements, whereas the maxillary denture measurements do correlate in a significant manner with the upper skeletal measurements.

Electromyography as an Aid in Diagnosis and Treatment Analysis: By W. Grossmann, M.D., D.Orth., L.D.S.R.C.S., and B. E. Greenfield, B.D.S., F.D.S.R.C.S., Orthodontic Department, University College Hospital Dental School, London, and Physiology Department, Royal College of Surgeons, London, England.

In 1956 Greenfield and Wyke evolved a standard electromyographic technique and used this to establish characteristic electromyograms for certain basic movements. The ultimate simplification shows three biting patterns: habitual, protrusive, and retrusive.

When an activator is worn for correction of a Class II, Division 1 malocclusion, the protrusive working bite is clearly shown by electromyography. This protrusive pattern remains even when the patient is not wearing the activator. Electromyography can assist in assessing the end result of orthodontic treatment and add to the available information when jaw relationships have changed.

The initial relationship in occlusion of the mandible in Class II, Division 2 malocclusion can be shown by electromyography. Greenfield confirmed by eletromyography a Class II, Division 2 case which started with a distal relationship and showed a forward relationship on completion of treatment. In another Class II, Division 2 case in which initially there had been a normal relationship, a distal displacement of the mandible during closing was demonstrated after proclination of the lower incisors.

True Class III cases show initially, when treated with a functional appliance, a distal pattern. This distal pattern is comparable to that seen after surgical correction of a Class III malocclusion (Kostečka). One Class III case returned to a normal pattern at the end of treatment.

79 Harley St.
London W. 1, England.

Cleft Palate: Morphology of the Human Mandible: By J. A. Bimm, D.D.S., D. A. Eisner, D.D.S., and C. R. Ibanez, C. D., Orthodontic Department, Faculty of Dentistry, University of Toronto, Toronto, Ontario.

Gonial angle and mandibular length were measured from oriented oblique cephalograms of normal children and children with cleft palate. These measurements were made at 6, 8, and 10 years of age, and appropriate statistical analyses were carried out. Measurements of gonial angle were also taken from oriented lateral cephalograms.

The following results were obtained:

1. The mandibles of the children with cleft palate who had been operated upon but not orthodontically treated were characterized by a greater gonial angle than that found in the mandibles of normal children.
2. No significant sex difference was found in gonial angle.
3. There was a consistent but nonsignificant tendency toward a shorter-than-normal mandibular length in the children with cleft palate, although this dimension tended to approach normal values with increase in age. The findings suggest that girls are either more severely affected or recover later and/or more slowly.
4. Boys were found to have significantly larger mandibular lengths than girls, and the difference may increase with age.
5. No correlation was found between gonial angle and mandibular length in the normal children at any of the age levels studied.
6. Caution should be exercised in comparing findings obtained from lateral cephalograms with those obtained from oblique projections.

The Influence of Headgear Design on Tooth Movement: By Donald R. Poulton, School of Dentistry, Division of Orthodontics, University of California, San Francisco, California.

A study has been made of the various directions of tooth movement obtained and its relationship to the type of headgear used.

An investigation of dentofacial changes produced by headgear therapy (*Angle Orthodontist,* October, 1959) led to further analysis of the results of treatment with headgears attached to the anterior part of an upper arch wire. Concepts which have evolved in the course of this continuing study include the following:

1. Observation of the direction of headgear pull from lateral headfilms taken while the patients are wearing headgears shows the relationship of upper tooth roots to the force applied.
2. The general tendency of appliance forces used in Class II correction to increase the occlusal plane-cranial base angle and to retard forward pogonion movement can be overcome by appliance-design changes in cases where this seems desirable.
3. Distal movement of upper tooth roots and crowns and simultaneous intrusion of incisors is possible with a headgear and intraoral appliance specifically designed to achieve this end.

1721 Santa Clara Ave.
Alameda, Calif.

A Cross-Sectional Study of Arch Deformity and Certain Oral and Dental Anomalies in the Cleft Palate Patient: By Capt. Frederick Charles Hamer, Jr., Columbia University, New York, New York.

A survey was made of eighty-eight unselected cleft palate patients (55.7 per cent male and 44.3 per cent female, eighty-seven white and one nonwhite) treated at the Columbia University Orthodontic Clinic within the last ten years, and a method was devised for classification. The majority of the cases showed a malpositioned premaxilla with alveolar collapse (29.5 per cent) or a unilateral alveolar collapse (28.4 per cent). By the angle classification, 65.9 per cent presented a Class I relationship except for the deformities associated with the cleft.

Of this population, seventy-six were used for radiologic study. Of these 67.1 showed one or more congenitally missing teeth, for an average of 1.2 teeth per case. The most frequently missing teeth, in order, were the lateral incisors, central incisors, and second premolars. The incidence of supernumerary teeth was 27.6 per cent, most often involving lateral incisors, cuspids, and central incisors, in that order. The central incisors (65.6 per cent), followed by the lateral incisors (31.2 per cent), were the teeth most often malformed. The lateral incisors, followed by the central incisors, were the teeth most often involved in the cleft.

U. S. Army Hospital Dental Clinic
Orthodontic Section
Fort Leonard Wood, Mo.

The Study of Tooth Migration in Normal, Hyperthyroid, and Hypothyroid Rats: By Alfred Leonard Shaw, University of Pittsburgh, Pittsburgh, Pennsylvania.

This study was undertaken to determine whether or not abnormal metabolic conditions affect the rate of tooth movement in rats. Sixty rats of the Long-Evans strain were divided equally into three groups, each group consisting of ten male and ten female animals. Group I remained a normal group and was maintained on a normal diet. Group II was given 108 μg of 3:5:3'-triiodothyronine in every 100 ml. of water and became the hyperthyroid group. Group III received 0.1 per cent 6n-propylthiouracil, added to the diet, and became the hypothyroid group.

Ten days after drug administration, the various metabolic states were confirmed by basal metabolism tests. At this time the maxillary right second molar was extracted from each rat, and its mesiodistal width was recorded. Thirty-three days following the extractions, basal metabolism tests were repeated and the animals were then killed. The maxilla was carefully dissected from each animal.

The extraction space for each animal was measured as the shortest distance between the maxillary right first molar and the maxillary right third molar. This measurement was subtracted from the width of the extracted tooth to obtain the amount of tooth migration occurring in each animal. The mean amount of tooth migration for each group was as follows:

Group I.	Normal female animals	1.08 mm.
	Normal male animals	0.91 mm.
Group II.	Hyperthyroid female animals	0.92 mm.
	Hyperthyroid male animals	1.00 mm.
Group III.	Hypothyroid female animals	0.98 mm.
	Hypothyroid male animals	0.87 mm.

A statistical analysis was conducted, with the following results:

1. No significant difference in amount of tooth migration was noted between the male and female hyperthyroid animals.
2. The same was true of the male and female hypothyroid animals.
3. A significant difference in the amount of tooth migration was noted between the male and female normal animals. This difference was significant at the 0.05 level of confidence.
4. When the three groups of male animals were compared, no significant difference was found in the amount of tooth migration, that occurred among these animals.
5. No significant difference in the amount of tooth migration was noted among the three groups of female animals.

From these results, it was concluded that hyperthyroidism and hypothyroidism have no effect on tooth migration in rats.

735 Orchard Ave.
Pittsburgh, Pa.

A Study of Tooth Migration in Rachitic and Non-Rachitic Rats: By Joseph H. Seipp, Jr., University of Pittsburgh, Pittsburgh, Pa.

Although there has been extensive research with vitamin D, little has been done to ascertain whether or not there is any relationship between the amount of tooth migration and the degree of vitamin D deficiency. There is disagreement in the literature as to whether a tooth will move just as rapidly in osteoid tissue as in calcified tissue.

This study was made in an attempt to determine whether there is any significant difference in the amount of migration of the maxillary and mandibular first and third molars following removal of the second molars of rats on a rachitic diet as compared with rats on a rachitic diet supplemented with vitamin D and also to determine histologically whether there was any delay in the healing of the alveolar socket following removal of the second molar. A total of forty-one rats were placed on the rachitic diet; eleven of these received a supplement of vitamin D, and the remainder did not. At 40 days of age the second molar was removed and the right tibia was radiographed to determine the degree of rickets. Twenty-five days later the animals were killed and the legs were radiographed again.

The histologic sections showed that the healing processes were greatly delayed and the sockets were filled with osteoid tissue, whereas the control rats showed complete calcification of the socket. In the apical regions of the rachitic animals, large amounts of cementoid and osteoid were observed. Areas of dentinoid and osteoid contact were occurring mainly in the regions of the bifurcations.

The amount of migration occurring in the rachitic animals did not significantly differ from that seen in the control animals.

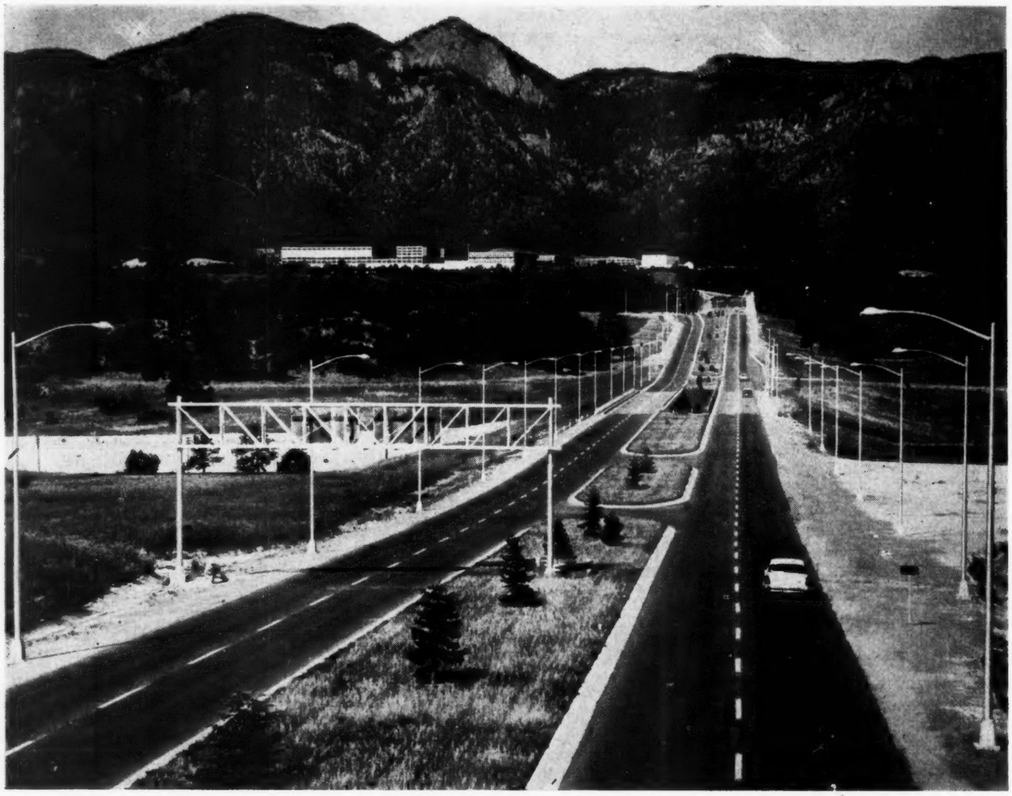
There was no statistical correlation between the degree of rickets and the amount of migration.

3301 N. Charles St.
Baltimore, Md.

News and Notes

American Association of Orthodontists

The next annual meeting of the American Association of Orthodontists will be held April 16 to 21, 1961, in Denver, Colorado, with headquarters in the fabulous new Denver Hilton Hotel.



The brand-new United States Air Force Academy near Colorado Springs, Colorado's newest visitor attraction. Located against the majestic backdrop of the Rampart Range, the $136,000,000 Academy is reached from U. S. Highways 85 and 87, just 10 miles north of Colorado Springs. More than 2,000,000 Colorado vacationers are expected to visit Uncle Sam's newest training academy during 1960.—*Colorado Visitors Bureau Photo by the Air Force Academy.*

The Colorado Visitors Bureau reminds us that Denver, one of the nation's youngest and fastest-growing major cities, has thirty first-class downtown hotels and 250 first-class motels and highway hotels. Convention facilities are said to be excellent. Denver is served by seven major airlines, seven major railroads, and seven major United States highways (including three on interstate system). The city has a cool, dry climate and the sun is said to shine on an average of 320 days each year.

Complete information concerning accommodations may be obtained by writing to Dept. AC, The Colorado Visitors Bureau, 225 West Colfax Ave., Denver 2, Colorado.

American Association of Orthodontists Excerpts From Minutes of the Board of Directors Meeting Washington, D. C., April 24 and 26, 1960

On motion, this was approved and referred to the Bylaws Committee for implementation:

7. The President has recommended that the annual dues be raised to permit the association to function on a self-supporting basis from the dues income rather than being partially dependent upon annual meeting income for the financial support of the Association.
   Resolved, that the annual dues shall be $45.00.

After discussion, this was approved and referred to the Bylaws Committee for implementation:

(b) *Termination of Associateship (Preceptorship) Training:*

There is pending an amendment to Chapter I relative to the termination of associateship (preceptorship) training in 1965. (The full context of this amendment is being circulated to the membership in the Secretary's letter.) Your Committee recommends that this be amended to make the termination date of associateship (preceptorship) training 1967 instead of 1965 to conform to the action of the American Dental Association Council on Dental Education recommendation adopted by the House of Delegates of the American Dental Association in September of 1959 that this termination date be 1967.

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Denver Hilton Hotel in Denver, Colorado, April 10 to 15, 1961. Orthodontists who desire to be certified by the Board may obtain application blanks from the secretary, Dr. Alton W. Moore, University of Washington School of Dentistry, Seattle 5, Washington.

Applications for acceptance at the Denver meeting, leading to stipulation of examination requirements for the following year, must be filed before March 1, 1961. To be eligible, an applicant must have been an *active* member of the American Association of Orthodontists for at least two years.

Great Lakes Society of Orthodontists

The thirty-first annual meeting of the Great Lakes Society of Orthodontists will be held Nov. 27 to 30, 1960, at the Netherland-Hilton Hotel in Cincinnati, Ohio. The scientific program will be as follows:

Cephalometrics as an Aid to Plan and Assess Orthodontic Treatment. Cecil Steiner, Beverly Hills, California.

Thumb-Sucking—Facts, Fictions, Permissive Treatment. David Hamilton, New Castle, Pennsylvania.

Control of Anchorage and Retention in Extraction Cases. Robert Moyer, Ann Arbor, Michigan.

Extraoral Traction Therapy. Sidney Asher, Chicago, Illinois.

Mandibular Ostectomy and Osteotomy. Robert Ponitz, Ann Arbor, Michigan.

Light Wire Differential Forces in the Treatment of Dental Malocclusions. Joseph R. Jarabak, Chicago, Illinois. (Schematic drawings and Kodachrome slides will be used to illustrate the three treatment steps.)

The Edgewise Appliance as Used With Extraoral Therapy. Samuel Ackerman, Cincinnati, Ohio.

Table Clinics.

In addition to the above, there will be a Fellowship Luncheon, featuring an address by William R. Humphrey, president of the American Association of Orthodontists; an American Board of Orthodontics Breakfast, open to all Society and diplomate members, with Edward Martinek of Detroit, Michigan, past president of the American Board of Orthodontics, as speaker; a Past President's Luncheon; an ''Over the Rhine'' party; and the President's Reception and Dinner.

Northeastern Society of Orthodontists

The Northeastern Society of Orthodontists will hold its fall meeting at the Statler-Hilton Hotel in Boston, Massachusetts, Nov. 13 to 15, 1960. A digest of the program follows.

Monday Morning

Case Report: Genetics. Warren R. Mayne, Salem, Massachusetts.

Some Problems in Planning Treatment for Class III Malocclusions. Ernest H. Hixon, Mexico City, Mexico.

Malocclusion and Civilization. Edward E. Hunt, Jr., Boston, Massachusetts.

Tooth Transplantation in Orthodontic Treatment. Walter C. Guralnick, Boston, Massachusetts.

Guest Speaker: Paul Dudley White (''Middle Age Fitness'').

Monday Afternoon

Retention Phase of Orthodontic Treatment. Robert E. Moyers, Ann Arbor, Michigan.

American Association of Orthodontists' Associateship (Preceptorship) Training Program. Philip E. Adams, Boston, Massachusetts.

Executive Session.

Tuesday Morning

Structure of the Head. Ture Bengtz, Museum of Fine Arts School, Boston, Massachusetts.

Some Problems Associated With Serial Extractions. Ernest H. Hixon, Mexico City, Mexico.

Light Differential Force Treatment as Developed by Dr. P. R. Begg. Harold D. Kesling, Westville, Indiana.

Cervical Anchorage; Adjunct and Treatment Appliance. Samuel J. Lewis, Kalamazoo, Michigan.

Guest Speakers:

William R. Humphrey, president, American Association of Orthodontists ("Report From the Officers and the Ad Interim Committee of the A. A. O.'')

J. A. Salzmann, chairman, American Board of Orthodontics.

Management of Perverted Function of the Tongue. Clifford L. Whitman, Hackensack, New Jersey.

Southern Society of Orthodontists

The Grand Hotel, located on the blue waters of the Gulf of Mexico at Point Clear, Alabama, was the setting for the thirty-ninth annual meeting of the Southern Society of Orthodontists, June 26 to 30, 1960.

The nearly 260 persons who attended (including members, wives, guests, etc.) felt amply repaid, as the scientific presentations, clinics, panel discussions, fun, and fellowship were of the highest order. Every phase of the meeting showed thoughtful planning and tireless work on the part of President M. Duke Edwards, the Local Arrangements Committee, and all those whose efforts made this one of our most outstanding meetings.

The scientific program included the following papers:

''Oro-facial Habits'' and ''Analysis of the Mixed Dentition.'' Robert E. Moyers.

"An Efficient Treatment Routine." Nathan G. Gaston.

"The Position of the Maxillary First Permanent Molar." Frank F. Lamons.

''Activities of the American Board of Orthodontics.'' L. Bodine Higley.

"Forum: "Early Versus Late Treatment." H. K. Terry (moderator), James E. Furr, Jr., Nicholas R. Nichols, III, Richard Starr, and Elbert M. Upshaw.

One of the highlights of the meeting was the presence of William R. Humphrey of Denver, Colorado, president of the American Association of Orthodontists. The topic of Dr. Humphrey's talk was "Greetings From the American Association of Orthodontists."

Dr. and Mrs. Humphrey, along with Dr. and Mrs. M. Duke Edwards and other officers of the Southern Society and their wives, were honored guests at a reception preceding dinner on Wednesday evening. The dinner was followed by dancing at Julip Point which, during the week, had been the scene of other enjoyable recreational activities, including boating, skiing, swimming, archery, and tall-tale swapping among members concerning activities (professional and otherwise) since our last annual meeting in Atlanta in 1959.

The last day's program consisted of the presentation of a number of splendid table clinics under the direction of Chairman H. K. Terry. The clinics were followed by the final business session, at which time Dr. Edwards was presented with the Past President's Key.

The following officers were elected:

President, Charles E. Harrison, St. Petersburg, Florida.

President-Elect, Prescott E. Smith, New Orleans, Louisiana.

Vice-President, James A. Bell, Pensacola, Florida.

Secretary-Treasurer, William H. Oliver, Nashville, Tennessee.

Junior Member, Board of Directors, William Weichselbaum, Savannah, Georgia.

Delegate to A.A.O., Boyd W. Tarpley, Birmingham, Alabama.

Alternate Delegate to A.A.O., Edgar D. Baker, Raleigh, North Carolina.

Sectional Editor, American Journal of Orthodontics, Oren A. Oliver, Nashville, Tennessee.

Associate Sectional Editor, American Journal of Orthodontics, G. Fred Hale, Raleigh, North Carolina.

The Southern Society's next meeting will be held Nov. 5 to 8, 1961, in St. Petersburg, Florida.

The following new members were elected to the Southern Society of Orthodontists:

Active:

James P. Bloom, Woodward Bldg., Birmingham, Alabama.

James E. Brown, 1278 Merry St., Augusta, Georgia.

Charles E. Fontaine, 1754 Old Government St., Mobile Alabama.

Edward H. Hamilton, Jr., 606 Main Ave., S.W., Knoxville, Tennessee.

Frank G. Hines, Jr., 1513 Hampton St., Columbia, South Carolina.

Ralph E. Karau, 515 Wythe St., Alexandria, Virginia.

Willis A. Michaels, 132 Adams Ave., Montgomery Alabama.

George J. Orr, 210 Langhorne Rd., Lynchburg, Virginia.
James E. Paulk, Medical Arts Bldg., Sarasota, Florida.
Ivon C. Rolader, 101 Third St., Atlanta, Georgia.
John Russell, Jr., First Columbus National Bank Bldg., Columbus, Mississippi.

Associate:

Frank C. Allen, St. James Bldg., Jacksonville, Florida.
James A. Boyd, 629 Hoke Dr., Petersburg, Virginia.
Maurice A. Brown, 4428 North Blvd., Baton Rouge, Louisiana.
James E. Cook, 1508 Washington St., Columbia, South Carolina.
Edwin R. Crenshaw, 1209 Wilcox Dr., Kingsport, Tennessee.
Lawrence J. Derbes, 1759 Government St., Baton Rouge, Louisiana.
Leslie W. Doss, 209 Maybelle Lane, Nashville, Tennessee.
Bernard Geltzer, 1790 Coral Way, Miami, Florida.
Fred C. Hamer, Jr., 306 E. Market, Charlottesville, Virginia.
Richard H. Hawkins, 1425 24th Ave., Gulfport, Mississippi.
Charles W. Holmes, III, Medical Arts Bldg., Sarasota, Florida.
Leon T. LaSalle, 1045 E. Atlantic Ave., Delray Beach, Florida.
Thomas C. Lawson, 2310 Whitesburg Dr., Huntsville, Alabama.
James L. McMillan, 500 E. Woodrow Wilson St., Jackson, Mississippi.
Donald R. Olson, 666 Sixth St., South, St. Petersburg, Florida.
Robert B. Parkes, Medical Arts Bldg., Jackson, Mississippi.
Bailey W. Prichard, 3387 Poplar Ave., Memphis, Tennessee.
Walter Richardson, 3387 Poplar Ave., Memphis, Tennessee.
John F. Sadler, 4623 Poplar Ave., Memphis, Tennessee.
George J. Sullivan, 4140 Shelbyville Rd., St. Matthews, Kentucky.

South Carolina Orthodontic Association

The orthodontists of South Carolina have recently formed the South Carolina Orthodontic Association. The object of this Association is to advance the science and art of orthodontics, to strive for higher standards in orthodontics, and to promote fraternal relationship among its members.

The annual meetings will be held in conjunction with the South Carolina State Dental Society Meetings, and other clinics will be held during the year.

The officers of the Association are as follows: *President,* C. O. Wells, Sr., *Vice-President,* W. J. Brockington; and *Secretary-Treasurer,* F. B. Hines, Jr.

European Orthodontic Society

The thirty-seventh annual session of the European Orthodontic Society will be held Sept. 7 to 11, 1961, in Bologna, Italy, under the presidency of Professor G. Maj.

For complete information, please write to Thirty-seventh European Orthodontic Society Meeting, Secretary's Office, Via Marsili 15, Bologna, Italy.

First Annual Orthodontic Seminar

The Chancellor, the Dean of the School of Dentistry, and the faculty of the Graduate Department of Orthodontics of the University of Kansas City, announce that the first annual orthodontic seminar will be held at Camelback Inn in Phoenix, Arizona, Nov. 6 to 9, 1960.

The program will consist of a symposium on the "Principles of the Four Major Appliances in Orthodontics," and the essayists will be authorities on the four various techniques.

Lancaster Cleft Palate Clinic

The Lancaster Cleft Palate Clinic announces that a seminar in diagnosis, research, and treatment of individuals with oral-facial-speech handicaps will be held Oct. 31 to Nov. 3, 1960. Members of the dental, medical, and speech professions may obtain applications by writing to Dr. M. Mazaheri, Chief, Dental Services, Lancaster Cleft Palate Clinic, 24 North Lime St., Lancaster, Pennsylvania.

University of Michigan

The University of Michigan, W. K. Kellogg Foundation Institute, announces the following postgraduate courses for the orthodontist:

Cephalometric Radiography. R. E. Moyers, A. H. Craven, T. M. Graber and Staff. Oct. 3 to 5, 1960.

Orthodontic Treatment During the Mixed Dentition. B. F. Dewel and R. E. Moyers. Oct. 24 and 25, 1960.

Practice Administration for the Orthodontist. C. E. Martinek and R. H. Campbell. Jan. 23 to 25, 1961.

Orthodontic Treatment Planning and Selective Appliance Therapy. W. L. Wilson. Feb. 20 and 21, 1961.

T. M. Graber Lectures in Europe

T. M. Graber, orthodontist of Kenilworth, Illinois, contributed lectures at the 100th anniversary meeting of the Swedish Dental Society and before the Norwegian Orthodontic Society in August, 1960. Dr. Graber also visited Prague, Warsaw, Moscow, and Leningrad.

Notes of Interest

Dr. Morris M. Berry announces the opening of his office for the practice of orthodontics exclusively at N. W. Corner Rosedale and Shore Road, Northfield, New Jersey.

Dr. B. Holly Broadbent, Sr., and Dr. B. Holly Broadbent, Jr., announce the removal of their orthodontic offices to the Young Medical Center, 11811 Shaker Blvd., Cleveland, Ohio.

John T. Jacob, B.S., D.D.S., M.S., announces the opening of his office at 159 East Alejo Rd., Palm Springs, California, practice limited to orthodontics.

Alfred L. Shaw, D.D.S., M.S., announces the opening of his office at 26933 Plymouth Rd., Detroit, Michigan, practice limited to orthodontics.

Deloit R. Wolfe, D.D.S., M.S.D., formerly of Atwood, Kansas, announces the removal of his office to 308 Medical-Dental Center, Missoula, Montana, practice limited to orthodontics.

Forthcoming meetings of the American Association of Orthodontists:

1961—Denver Hilton Hotel, Denver, Colorado, April 16 to 21.
1962—Statler Hotel, Los Angeles, California, April 28 to May 3.
1963—Americana Hotel, Miami Beach, Florida, April 28 to May 2.
1964—Palmer House, Chicago, Illinois, May 10 to 14.
1965—Dallas Statler-Hilton, Dallas, Texas, April 25 to 30.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and its component societies. The Editorial Board of the JOURNAL is composed of a representative of each of the component societies.

American Association of Orthodontists
(Next meeting April 16-21, 1961, Denver)

President, William R. Humphrey - - - - - - - - - - Republic Bldg., Denver, Colo.
President-Elect, Dallas R. McCauley - - - - - - 410 S. Beverly Dr., Beverly Hills, Calif.
Vice-President, Cecil G. Muller - - - - - - - - - 101 S. 35th Ave., Omaha, Neb.
Secretary-Treasurer, Earl E. Shepard - - - - - - - 225 South Meramec, Clayton, Mo.

Central Section of the American Association of Orthodontists

President, Leo B. Lundergan - - - - - - - - - - 8000 Bonhomme Ave., St. Louis, Mo.
Secretary-Treasurer, Kenneth E. Holland - - - - - - 1019 Sharp Bldg., Lincoln, Neb.
Director, Elmer F. Bay - - - - - - - - - - - - 216 Medical Arts Bldg., Omaha, Neb.

Great Lakes Society of Orthodontists
(Next meeting Nov. 27-30, 1960, Cincinnati)

President, Hunter I. Miller - - - - - - - - - - - 1416 Mott Foundation Bldg., Flint, Mich.
Secretary, Edward A. Cheney - - - - - - - - - - 1201 Bank of Lansing Bldg., Lansing, Mich.
Director, Harlow L. Shehan - - - - - - 601 Jackson City Bank Bldg., Jackson, Mich.

Middle Atlantic Society of Orthodontists
(Next meeting Oct. 9-11, 1960, Atlantic City)

President, Kyrle W. Preis - - - - - - - - - - - 700 Cathedral St., Baltimore, Md.
Secretary-Treasurer, Charles S. Jonas - - - - - - Mayfair Apts., Atlantic City, N. J.
Director, Louis E. Yerkes - - - - - - - - - - - - - 825 Linden Ave., Allentown, Pa.

Northeastern Society of Orthodontists
(Next meeting Nov. 13 to 15, 1960, Boston)

President, Henry C. Beebe - - - - - - - - - - 60 Charlesgate West, Boston, Mass.
Secretary-Treasurer, David Mossberg - - - - - - 36 Central Park S., New York, N. Y.
Director, Norman J. Hillyer - - - - - - - - - 230 Hilton Ave., Hempstead, L. I., N. Y.

Pacific Coast Society of Orthodontists
(Next meeting Aug. 6-10, 1961, Seattle)

President, E. Allen Bishop - - - - - - - - - - - 703 Cobb Bldg., Seattle, Wash.
Secretary-Treasurer, Warren A. Kitchen - - - - - 2037 Irving St., San Francisco, Calif.
Director, William S. Smith - - - - - - - - - - - - 2530 Bissell Ave., Richmond, Calif.

Rocky Mountain Society of Orthodontists

President, William A. Blueher - - - - - - - - - - 801 Encino Pl., Albuquerque, N. M.
Secretary-Treasurer, E. H. Mullinax - - - - - - - 8790 W. Colfax, Lakewood, Colo.
Director, Ernest T. Klein - - - - - - - - - - - 707 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists
(Next meeting Nov. 5 to 8, 1961, St. Petersburg)

President, Charles E. Harrison - - - - - - - - - - 362 Sixth St., S., St. Petersburg, Fla.
Secretary-Treasurer, William H. Oliver - - - - - - - 1915 Broadway, Nashville, Tenn.
Director, Boyd W. Tarpley - - - - - - - 2118 Fourteenth Ave., S., Birmingham, Ala.

Southwestern Society of Orthodontists

President, John W. Richmond - - - - - - - 493 Brotherhood Bldg., Kansas City, Kan.
Secretary-Treasurer, Tom M. Matthews - - - - - - 8215 Westchester Dr., Dallas, Texas
Director, Nathan Gaston - - - - - - - - - - - - - - 701 Walnut St., Monroe, La.

American Board of Orthodontics
(Next meeting April 10-15, 1961, Denver)

President, Wendell L. Wylie - - - - - University of California School of Dentistry, San Francisco, Calif.
Vice-President, J. A. Salzmann - - - - - - - - 654 Madison Ave., New York, N. Y.
Secretary, Alton W. Moore - - University of Washington School of Dentistry, Seattle, Wash.
Treasurer, Paul V. Reid - - - - - - - - - 1501 Medical Arts Bldg., Philadelphia, Pa.
Historian, B. F. Dewel - - - - - - - - - - - - - 708 Church St., Evanston, Ill.
Director, Frank P. Bowyer - - - - - - - - - 608 Medical Arts Bldg., Knoxville, Tenn.
Director, Nathan G. Gaston - - - - - - - - - - - - 701 Walnut St., Monroe, La.